eum Library

Volume 16 JULY, 1942 JUL 3 1942 Number 4

JOURNAL OF PALEONTOLOGY

A publication of The Society of Economic Paleontologists and Mineralogists *and* The Paleontological Society *with the generous support and cooperation of* The American Association of Petroleum Geologists *and* The Geological Society of America

CONTENTS

Bryozoa from the Ordovician Bromide formation, Oklahoma ..... *A. R. Loeblich* 413

Chester Bryozoa of Illinois and western Kentucky ..... *Arthur C. McFarlan* 437

A new *Unio* from the Morrison formation of Colorado ..... *Edward L. Holt* 459

Some Miocene Foraminifera from subsurface strata of coastal Texas .... *J. B. Garrett* 461

Worthenella, Setigerella, and new productid species ..... *A. H. Sutton* 464

Ordovician trilobites from Nevada ..... *Samuel Holliday* 471

A goniatite from the Mississippian Fern Glen formation of Illinois ..... *A. K. Miller and Courtney Werner* 479

A new ostracode from the Claiborne Eocene of Texas ..... *Morton B. Stephenson* 482

Halymenites, addendum ..... *Joseph M. Patterson* 483

A new species of *Discorbis* from the Weches formation of Texas ..... *J. B. Garrett* 484

The skeleton of an immature pelycosaur, *Dimetrodon* cf. *grandis,* from the Permian of Texas ..... *Charles W. Sternberg* 485

Four new genera of Paleozoic Gastropoda ..... *J. Brookes Knight* 487

Bibliography and index to new genera, species, and varieties of Foraminifera for the year 1939 ..... *Hans E. Thalmann* 489

REVIEWS 521

SOCIETY RECORDS AND ACTIVITIES 524

EDITORS

C. Wythe Cooke, for the Paleontological Society.

Norman D. Newell, for the Society of Economic Paleontologists and Mineralogists.

The Journal of Paleontology is published bi-monthly. The numbers issued in January, May, and September are sponsored by The Paleontological Society in cooperation with The Geological Society of America; those issued in March, July, and November are sponsored by The Society of Economic Paleontologists and Mineralogists in cooperation with The American Association of Petroleum Geologists.

The subscription price of the Journal of Paleontology is $6.00 per year prepaid to addresses in the United States.

Single numbers, $2.00 each.

Postage is charged extra for all other countries in the Postal Union, 40 cents on annual subscriptions (total $6.40).

The Journal will furnish reprints at cost. Orders should accompany manuscript.

Communications about the Journal, subscriptions, rates, memberships, change of address, and nonreceipt of preceding numbers should be addressed to Society of Economic Paleontologists and Mineralogists, P. O. Box 979, Tulsa, Oklahoma. Claims for nonreceipt of preceding numbers must be sent in within three months of the date of publication in order to be filled gratis. Communications in regard to advertising should be addressed to Norman D. Newell, University of Wisconsin: Madison, Wisconsin.

Communications in regard to manuscripts, or purely editorial matters should be addressed to Norman D. Newell, University of Wisconsin: Madison, Wisconsin, or C. Wythe Cooke, U. S. Geological Survey, Washington, D.C.

Contributors are requested to instruct their photographers to illuminate fossils from the upper left side, the conventional manner. Plates normally should be arranged for publication at the size of 5 by 7 inches, exclusive of margins, heading, and title. Printed numerals of standard size and form may be obtained free from either editor. When requesting them state number of plates and the dimensions of each plate.

Entered as second-class matter at the Post Office at Tulsa, Oklahoma, under the Act of March 3, 1879. Acceptance for mailing at special rate of postage provided for in paragraph 4, section 538, P. L. and R., authorized April 3, 1935.

Additional entry as second-class matter at the Post Office at Menasha, Wis.

GEORGE BANTA PUBLISHING COMPANY, MENASHA, WIS.

JOURNAL OF PALEONTOLOGY

A publication of THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS *and* THE PALEONTOLOGICAL SOCIETY *with the generous support and cooperation of* THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS *and* THE GEOLOGICAL SOCIETY OF AMERICA

VOLUME 16 JULY, 1942 NUMBER 4

BRYOZOA FROM THE ORDOVICIAN BROMIDE FORMATION, OKLAHOMA[1]

ALFRED R. LOEBLICH, JR.
Tulane University, New Orleans, Louisiana

ABSTRACT.—Thirty-one species of bryozoa are illustrated and described from the Bromide formation of the Arbuckle and Wichita Mountains and the Criner Hills of Oklahoma, 26 of which are new. The five previously described species occur in the Decorah formation of the Upper Mississippi Valley, their presence here suggesting the lower Trenton age of the Bromide. A summary of previous stratigraphic work on the Bromide formation is made and a measured section of the type locality is presented for the first time.

INTRODUCTION

SINCE THE original definition of the Bromide formation, a number of writers have discussed it, with little agreement as to its age in comparison with the standard section, or as to local correlation within limited areas. Even its upper and lower limits have been controversial. Various criteria have been used in discussion of the above questions, among them general lithology, heavy mineral analysis, and a few fossils. Although correlation by means of fossils is almost universally accepted as the most reliable method, almost no detailed faunal studies of this formation have been published.

Bryozoa are possibly the best group of organisms for close stratigraphic work in the Middle and Upper Ordovician, because of their widespread geographic and limited stratigraphic range and also because accurate specific identification can be made from small fragments. Yet, because of the fact that bryozoa must be thin-sectioned, they are generally not studied and often not even collected by stratigraphers and when mentioned are frequently listed merely as "bryozoans."

Although it is impossible to study the brozoa of the Bromide formation without some reference to the stratigraphic problems involved, the purpose of the present paper is primarily to describe some of the more unusual species and to discuss their structural features. No attempt has been made to describe here all of the Bromide bryozoa, as these fossils comprise a large percentage of the fauna. In some beds the bryozoa are almost the only megascopic organisms represented.

PREVIOUS STRATIGRAPHIC WORK

The Bromide is the uppermost formation of the Simpson group of Ordovician age, cropping out in the Arbuckle and Wichita Mountains and in the Criner Hills of southern Oklahoma. As originally defined by Ulrich (1911, Pl. 27) this formation included beds from Blount to Decorah inclusive in

[1] A dissertation submitted at the University of Chicago, in partial fulfillment of the requirements for the Ph. D. degree.

age, or from the upper Chazyan through most of the Black River. This original definition consisted merely of placing the name Bromide in a table of formations, and no lithologic description, type section, thickness nor characteristic fossils were given. The Bromide was not considered as a formation of the Simpson group, but all the underlying formations of this group, as now understood, were included in the Simpson.

Dake (1921, p. 59) considered the upper 300 feet of the Simpson group, thus including the Bromide formation, as equivalent to beds as young as Lowville and early Black River in age, and closely related to the Platteville.

Later, Ulrich (1927, p. 29 and fig. 2) divided the Simpson into three faunal divisions, the lower division having been deposited in a sea of Pacific origin and lower Chazyan in age; the second division, or typical Bromide, containing an Atlantic fauna, and the third division, consisting of beds provisionally referred to the Bromide formation, being northern in origin, as it possessed representatives of the Decorah and Prosser Faunas of Minnesota.

Edson (1927, fig. 1) correlated the Bromide with the entire Blount and part of the Lowville and Black River, and considered the lower part of the overlying Viola formation equivalent to the upper Black River. Later (1929, fig. 1) however, she considered the Bromide as equivalent to the entire Blount—Black River sequence.

Decker (1930, p. 1495) gave a table, credited to Ulrich, in which the Simpson was divided, in ascending order, into Oil Creek, Bromide and West Spring Creek formations, the latter having a member termed Criner, and in which the lower two formations were correlated with the Chazyan and the upper with the upper Black River and lower Trenton. A second table credited to Ulrich for the same year, 1928, but evidently slightly later, was given by Decker, in which the Simpson was subdivided into seven formations. The term West Spring Creek was dropped and its former member, the Criner, was raised to the rank of a formation, but its position reversed so that it was here placed below the Bromide formation. The seven formations given at this time were, in ascending order, Joins Ranch, Nebo, Falls, McLish, Tulip Creek, Criner and Bromide.

Later Ulrich (1929, pp. 76–77) correlated the Bromide with approximately the upper two-thirds of the Black River group and the lower two-thirds of the Prosser and considered its fauna northern in origin. The underlying Criner was said to be separated from the Bromide by a stratigraphic break and on the basis of genetically comparable fossils, not occurring elsewhere, was correlated with the Blount and Chambersburg formations to the east. The Viola, overlying the Bromide, was considered as later than Trenton in age, lying somewhere in the Cincinnatian or in the hiatus which elsewhere separates that series from the Richmond, according to Ulrich. Thus, at this time, no Trenton equivalents were considered to be present in the Arbuckle area.

Decker (1930, p. 1497) abandoned the term Criner, of Ulrich, including those beds in the Bromide, which he correlated with the Trenton and Black River. Later Decker, in Decker and Merritt (1931, p. 44), further stated that the Bromide is closely related to the Plattin and Platteville of Illinois and Wisconsin and contains many of the species of the Black River of Minnesota. Some species which are more characteristically Trenton were said to occur in the upper part with those of Black River age.

Bridge, in Reeside (1933, Pl. 2), put forth a tentative correlation of Ordovician formations, in which he stated that certain exact equivalents of the Bromide were known, including the following: Lowville of New York and the northern Appalachian mountains; Bays (type)=Moccasin type, of the southern Appalachians; Carters limestone of Tennessee; Tyrone of the Cincinnati Arch area; Platteville of the Upper Mississippi Valley and the Plattin of the Ozark region. It is to be realized that in a publication of this type no details can be given as to the evidence supporting the various correlations. In view of the "exact equivalents" listed, however, the present writer regrets that the basis for these conclusions has not as yet been published elsewhere. Bridge considered the Bromide, including the Criner and Cool Creek of Ulrich, to be lower Black River in age and recognized only five formations in the Simpson group, the Joins, Oil

Creek, McLish, Tulip Creek and Bromide.

Ulrich (1933, p. 105) divided the Simpson into eight formations, adding the Cool Creek to those previously listed. His classification at this time contained the Joins, Oil Creek, Falls, McLish, Tulip Creek, Cool Creek, Criner and Bromide, in ascending order. He correlated the typical Bromide with the Platteville and Plattin limestone of Wisconsin and Missouri and the Lowville of New York, all of which are of lower Black River age, and he concluded that the Cool Creek and Criner formations have no direct counterparts in the Ordovician sections east of Oklahoma. It should be noted that both the Cool Creek and Criner of Ulrich are included in the Bromide by Decker.

Later in the same year, Decker (1933, pp. 55–57), in a lecture before the Tulsa Geological Society, the digest of which was prepared for publication by Mr. Glen S. Dille, divided the Simpson group into the Joins, Oil Creek, McLish, Tulip Creek and Bromide. These were listed in a table with three subdivisions of the underlying Arbuckle group. The latter were, in descending order, West Spring Creek formation, Alden limestone (*Ceratopea* bed) and Cool Creek limestone. The term West Spring Creek had already been used by Ulrich (1933, p. 105) for a formation of the Simpson. Wilmarth (1938, p. 2312) erroneously stated that Decker (1933, pp. 56–57) divided the Simpson group of the Arbuckle and Wichita Mountains into Bromide, Tulip Creek, McLish, Oil Creek, Joins, West Spring Creek, Alden and Cool Creek, in descending order. The table given by Decker (1933, p. 55) is somewhat confusing as the boundary between the Simpson and Arbuckle groups is not definitely shown, which undoubtedly led Wilmarth to her mistake. However, it is clearly stated (pp. 56–57) in the text that only five formations were included in the Simpson. In two later papers concerning the Arbuckle group, Decker (1939a, table 1; 1939b, pp. 25–26) again used the terms West Spring Creek and Cool Creek for formations in the Arbuckle group, changing the name of the preoccupied Alden to Kindblade, although he made no further provision for the also preoccupied terms West Spring Creek and Cool Creek.

Ulrich, in Ulrich and Cooper (1938, pp. 23–24), also used Cool Creek for an Arbuckle formation, of middle Canadian age, citing it with Decker in parenthesis, evidently crediting the formational name to him, and the name West Spring Creek for an upper Canadian formation of the Arbuckle group, although both of these terms had originally been used by Ulrich for formations of the Simpson group.

Bassler and Kellett (1934, p. 48) used the eight formations of Ulrich, but the upper three formations, Bromide, Criner and Cool Creek, were all placed in the Black River.

Edson (1935a, fig. 4), in a stratigraphic column, used only four formations for the Simpson group, the Joins, Oil Creek, McLish and Bromide, in ascending order, and used the term Webster for beds immediately overlying the Bromide. She (1935b, p. 1123) credited Ulrich for the term Webster, a formation of late Black River and early Trenton age. Ulrich was said to have correlated the Webster with the Decorah formation of the Upper Mississippi Valley and with the lower Viola of Taff (1903, pp. 3–4).

Summary.—Although all of the formational names of the Simpson group were originally used by Ulrich, none of them were defined nor were type localities designated. Decker, in Decker and Merritt (1931, pp. 13–49), later defined five of these, the remainder, as well as the overlying Webster formation of Ulrich, having not yet been well defined. However, Decker's conception of two of these, the McLish and Bromide, is not the same as that of Ulrich.

It is also regrettable that two of the formational names of the Simpson have also been used for formations of the Arbuckle group. These two, which have not been clearly defined as divisions of the Simpson, have been well defined with type localities designated, as formations of the Arbuckle group, although the former usage has priority. The writer questions the validity of such double usage of formational names. If one formation of the Arbuckle group was changed due to its prior use elsewhere, to be consistent the other two Arbuckle names originally used for Simpson formations should also be changed.

Throughout past years, the number of formations recognized in the Simpson group

TYPE SECTION OF THE BROMIDE FORMATION

Bed	Thickness in feet	Total thickness in feet	Description
			Viola limestone
1.	5.5	5.5	Thin bedded limestone in beds 4 to 8 inches thick. (Top of Bromide.)
2.	7.0	12.5	Thin-bedded limestones.
3.	11.2	23.7	Buff and gray thin-bedded limestones, 1 to 2 inches thick.
4.	7.0	30.7	Yellow and gray limestone, beds 5 to 9 inches thick.
5.	3.9	34.6	Thin-bedded limestones, alternating with green shales.
6.	16.0	50.6	Upper part of buff to brown shales, lower portion greenish gray to buff shale, including a 2.5 foot limestone near base.
7.	6.5	57.1	Upper 4 feet of yellow clay shales with numerous lime nodules, lower 2.5 feet of olive-green shale.
8.	3.5	60.6	Yellow-brown limestones in beds 4 to 9 inches thick.
9.	2.5	63.1	Yellowish brown limestones alternating with shale.
10.	2.5	65.6	Lens of thin sandy limestone and green shale, extending laterally approximately 30 feet and grading into limestone.
11.	4.0	69.6	Yellow-brown thin-bedded limestones.
12.	5.0	74.6	Yellow-green clay shales with a 5-inch bed of fossiliferous limestone at the base.
13.	3.0	77.6	Light-green clay shale, containing calcareous nodules.
14.	10.0	87.6	Yellow and green fossiliferous shales.
15.	40.0	127.6	Yellow-brown limestones exposed on the slope to the north, down to the base of a short valley.
			Bottom of section covered.

by different writers, and at various times by a single writer, has varied from one to two, three, four, five, seven and eight. If workers in the past, in naming new formations, had also given a clear definition and exact upper and lower limits, designated a type locality and given at least some of the characteristic fossils, many of the problems in nomenclature, extent of formations and their correlation, would never have arisen.

THE BROMIDE FORMATION

The Bromide formation of the Arbuckle and Wichita Mountains, as here in used, is the same as that defined and mapped by Decker, in Decker and Merritt (1931, p. 40), and thus includes the typical Bromide, Criner and Cool Creek formations of Ulrich.

The type locality of the Bromide formation is along an old road on a hill northwest of the old Galbraith Hotel in the town of Bromide, in section 32, Township 1 South, Range 8 East, Johnston County, Oklahoma, but no measured section has previously been published. The following section at the type locality was measured during the summer of 1938 by Dr. C. E. Decker and the writer.

THE BROMIDE BRYOZOA

Methods of study.—The method used in thin sectioning bryozoan specimens in preparation for study is that described by the writer (1940, p. 378). The thin-sections were examined under a monocular microscope at magnifications ranging from ×20 to ×300. The writer has found that minute wall structure is best studied under magnifications from ×100 to ×300, as at these comparatively high magnifications structures are clearly and definitely shown that under low powers are easily overlooked. In preparing the illustrations the sections were photographed by means of time exposures at a magnification of ×20, on 2¼ by 3¼ inch cut film and enlargments were printed at ×30 and ×75. The prints were retouched with pencils, with constant reference to the thin-sections. While most of the structures are apparent in an unretouched photograph, crystallization features and mud fillings in the zooecial tubes often obscure important structures. In the opinion of the writer, careful retouching minimizes the unnecessary portions without loss of accuracy. The plates were assembled at one and one-half times their published size and the consequent reduction gives the present magnifications of ×20 and ×50.

Conclusions.—The following bryozoa have been listed by Decker, in Decker and Merritt (1931, p. 48), as occurring in the

Bromide formation. The writer has added after each specific name the geologic range as given by Bassler (1915).

Chasmatopora reticulata, Black River–Trenton (Decorah)
Corynotrypa delicatula, Stones River–Richmond
Diastoporina flabellata, Trenton (Prosser)
Homotrypella cf. *ovata*, Trenton (Prosser)
Monotrypa magna, Black River (Platteville)
Pachydictya occidentalis, Decorah
Prasopora simulatrix, Black River—Trenton
Rhinidictya exigua, Decorah
Rhinidictya mutabilis, Decorah and Prosser
Rhinidictya mutabilis major, Decorah
Rhinidictya cf. *neglecta*, Trenton (Wilmore)
Stictopora elegantula, Trenton (Trenton Falls)
Stictoporella cribrosa, Decorah

Neglecting the long-lived *Corynotrypa* and *Monotrypa magna*, the bryozoa are indicative of Trenton age, that is, if the Decorah is considered to be Trenton, as it has been by Kay (1937, p. 294). While Decker, in Decker and Merritt (1931, p. 44), stated that he considered the Bromide to be closely related to the Plattin of Missouri and the Platteville of Wisconsin and Illinois, the species listed above are predominantly Trenton. *Monotrypa magna* Ulrich has a limited range in the Platteville formation and it would not be expected to occur in the assemblage listed above. Furthermore, the writer has collected and sectioned numerous specimens of large-pored, massive bryozoa from the so-called *Monotrypa magna* zone, occurring near the middle of the Bromide formation, from many of the localities from which it has been recorded, and has found that specimens commonly referred to *Monotrypa magna* are in reality species of several genera of the family Prasoporidae, a species of a probable new genus that is closely allied to *Diploptrypa*, and in addition, several species of *Anolotichia*. No specimens have been encountered by the writer as yet that belong to *Monotrypa magna* Ulrich, nor even to that genus. It is probable that the listing of this species is in this case due to misidentification.

In addition to the above listed species, the writer has added the following which are indicative of Trenton age: *Batostoma winchelli* Ulrich, *Dekayella praenuntia echinata* Ulrich, *Nicholsonella laminata* Ulrich, *Hemiphragma irrasum* (Ulrich) and *Anolotichia impolita* (Ulrich). The new species described are also more closely related to the Trenton forms of Minnesota than to any other faunal group. The evidence presented by the bryozoa suggests a lower Trenton age, and the fauna is closely allied to the Decorah of Minnesota.

ACKNOWLDGEMENTS

The writer is indebted to Dr. C. E. Decker, of the University of Oklahoma, for guidance in the field and assistance in collecting material used in this study and for permission to publish the type section, measured jointly with the writer during the summer of 1938; to Dr. R. S. Bassler, of the United States National Museum, for checking the species and for numerous suggestions concerning them, many of which are here incorporated.

Acknowledgment is also made of the assistance of Mr. M. S. Chappars, of Walker Museum, in photographing the thin sections, and of Helen Tappan Loeblich, who retouched the photographs.

Finally, the writer is deeply grateful to Dr. Carey Croneis for his direction of this research and for numerous valuable suggestions and criticisms.

TYPES

All type specimens and thin sections are deposited in Walker Museum, University of Chicago. A portion of each holotype, and in some cases paratypes as well, are deposited in the United States National Museum at Washington, D. C., and paratypes of some of the species are also in the collection of the writer.

SYSTEMATIC DESCRIPTIONS

Order CYCLOSTOMATA Busk, 1852
Family CERAMOPORIDAE Ulrich, 1882
Genus ANOLOTICHIA Ulrich, 1890
ANOLOTICHIA DECKERI Loeblich, n. sp.
Plate 61, figures 1, 2.

Zoarium massive, subhemispherical, over 6 cm. in height, 10 cm. in length and 7 cm.

in width. Zooecia polygonal, with small lunaria, indistinct on the surface, occupying one of the angles. Mesopores small, angular and few in number.

Zooecia averaging 4 in 2 mm., possessing fairly thin granular amalgamate walls, in very thin sections appearing constructed of alternating light and dark tissue. Lunarium occupying one corner of the zooecium, pierced by 3 circular tubuli which may project into the zooecial cavity.

Zooecial tubes with slightly crenulated walls, crossed by thin straight diaphragms, which become indistinct as sections are ground very thin, spaced from less than one up to 3 or more tube diameters apart. Diaphragms irregularly spaced in a single tube, being close together in one portion, then absent for a long distance. Lunarial tubuli appear in longitudinal section as long clear streaks in the walls, which appear constructed of alternating layers of light and dark tissue. Occasionally in longitudinal section the walls are broken by circular clear pores. Mesopores irregular in width, occasionally appearing beaded and often not reaching the surface.

Remarks and comparisons.—*Anolotichia deckeri* differs from *A. impolita* (Ulrich) in the massive zoarial form, in having slightly larger zooecia, possessing fewer mesopores and in lacking the small aggregates of these.

Locality.—Bromide formation, 35 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48559; portion of holotype in U. S. National Museum.

Anolotichia impolita (Ulrich)[2]
Plate 61, figures 5, 6

Zoarium palmate, terminal marginal indentations giving a digitate appearance, zoarium up to 4 cm. in width and one cm. in thickness; surface smooth. Small aggregates of 4 or 5 mesopores occur scattered over the surface, with a few isolated ones between the zooecia.

About 5 zooecia occur in 2 mm., possessing granular, amalgamated walls and appearing polygonal in outline, with a small crescentic lunarium occupying one of the corners. Lunaria generally perforated by 3 pores, appearing as clear spots in section. Small, polygonal mesopores are irregular in size and shape.

Zooecial tubes of irregular width in the axial region, with thin crenulated walls; diaphragms spaced as close as 1.5 to 2.0 tube diameters apart, and bend gently toward the surface. In the more mature region the tubes have thicker walls, in section appearing constructed of alternating lighter and darker layers of granular material, and crossed by more numerous, thin diaphragms that disappear as sections are ground very thin, spaced as close as one-third tube diameter apart. Lunarial pores easily seen as clear tubes along the zooecial wall. Mesopores occasionally appear beaded in the more mature regions.

Remarks and comparisons.—The Bromide specimens have a frondescent zoarium, more numerous diaphragms in the mature region and a somewhat greater number of mesopores than do the forms from Minnesota, but otherwise they are very similar.

Locality.—Bromide formation, 26 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Hypotypes U. C. 48557, also in U. S. National Museum.

Anolotichia spinulifera
Loeblich, n. sp.
Plate 61, figures 3, 4

Zoarium of encrusting layers, forming an irregular lobed mass, often around other bryozoa, the holotype being 4 cm. in height and 3.5 cm. in greatest width. Surface exhibits prominent small lunaria in the angles of zooecia, projecting into the zooecial cavity. Lunarial tubuli project above surface of lunaria as prominent spines.

Five polygonal zooecia occur in 2 mm. and possess granular amalgamated walls. Lunaria with 3 lunarial pores, appearing as clear spots in tangential section.

Zooecial tubes prostrate for a very short distance, then turned abruptly toward the vertical, are crossed by straight diaphragms, varying from less than one up to 2 tube diameters apart. Walls crenulated, com-

[2] The synonymy of the previously described species may be found in Bassler (1915) and is therefore not repeated here.

posed of alternating layers of dark and light granular material.

Remarks and comparisons.—*Anolotichia spinulifera* differs from the associated *A. impolita* (Ulrich) in its encrusting mode of growth and in having fewer mesopores and a more prominent lunarium, with the lunarial tubuli projecting as short spines.

Locality.—Bromide formation, 140 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48558; portion of holotype in U. S. National Museum.

Family FISTULIPORIDAE Ulrich, 1882
Genus FISTULIPORA McCoy, 1850
FISTULIPORA? BASSLERI Loeblich, n. sp.
Plate 61, figures 9, 14

Zoarium ramose to encrusting, in the holotype of anostomosing, round to flattened branches, 0.3 to one cm. in diameter, arising from a wide basal expansion attached to rocks or other bryozoa, older parts of zoarium completely closing the fenestrules. Zooecia show small but prominent arched lunaria on the surface. Numerous elevated, at times depressed or level, substellate maculae occur on the surface, spaced 1.8 to 2.4 mm. apart, from center to center.

Zooecial apertures adjacent to maculae are 0.2 to 0.25 mm. in long dimension, being larger and more elongated than the more nearly circular intermacular zooecia, which are 0.12 to 0.16 mm. in diameter. The zooecia adjacent to maculae are elongate in the direction of the macular centers and possess a well-developed lunarium on that side, occupying almost half of the zooecial circumference, but not observed to project into the zooecial cavity. Centers of lunaria possess a small clear spot, much as in *Anolotichia*. Zooecia rarely in contact, being separated by vesicular interstitial tissue. Macular areas appear solid in section.

Zooecial tubes passing in a gentle curve from the axial region to the periphery and crossed by bent or curved diaphragms, which are spaced one-half to one tube diameter apart in the more mature region, with only an occasional diaphragm in the axial region. The lunarial pores may appear in longitudinal section as a clear tube. Large, loosely arranged vesicles fill the interzooecial space.

Remarks and comparisons.—This species varies somewhat in internal characters. Some specimens lack the characteristic lunarial pores while others, in addition to the lunarial pores, have numerous pores piercing the macular and interstitial areas. Zooecia vary from 0.12 to 0.52 mm. in greatest diameter and diaphragms are spaced at intervals varying from one-fifth to three or more tube diameters apart. Diaphragms may be curved, arched upward, horizontal or cup-shaped. It is probable, however, that these differences and also those of zoarial form are growth features.

The vesicular tissue of this species is the type found in primitive species of *Fistulipora*, and all specimens exhibit a well-formed lunarium. The lunaria, however, may be pierced by a single clear pore, recalling features of *Anolotichia*, but in addition other secondary pores are present in the interzooecial spaces and in the maculae, similar to those found in *Fistuliporella* and in some species of *Ceramoporella*. According to Dr. R. S. Bassler there are similar species in the Chazyan of the Appalachian Valley, that differ from each other in the presence or absence of some of the characters mentioned above. In view of the unstable character of the group of early Fistuliporoids it has been thought best to refer this species questionably to *Fistulipora* until the group can be studied in detail and the true generic characters determined.

Fistulipora? bassleri differs from *F. primaeva* Bassler in having an encrusting to ramose and anastomosing form, rather than a massive one, and in possessing a lunarial pore in addition to the granular acanthopore-like tubes.

Locality.—Type locality, Lower Bromide, in the basal sand series where it forms a solid bed or biostrome, 6 to 8 inches thick, at Rock Crossing of Hickory Creek, in the Criner Hills, sec. 35, T. 5 S., R. 1 E., Oklahoma; in green shales, 240 feet below the top of the formation, slightly above the previously mentioned horizon but at the same locality; common in a shaly limestone, 170 feet below the top of the formation, west of the Nebo store, sec. 22, T. 2 S., R. 3 E., Arbuckle Mountains, Murray County,

Oklahoma; 260 feet below the top of the formation on the West Branch of Sycamore Creek, in the northwest one-fourth of sec. 27, T. 3 S., R. 4 E., Arbuckle Mountains, Johnston County, Oklahoma.

Types.—Holotype U. C. 48551, portion of holotype in U. S. National Museum; paratypes U. C. 48552, 48553, 48554, 48555, 48556; paratypes also in U. S. National Museum.

Order TREPOSTOMATA Ulrich, 1882
Family PRASOPORIDAE Simpson, 1897
Genus ATACTOPORELLA Ulrich, 1883

ATACTOPORELLA BELLULA
Loeblich, n. sp.
Plate 61, figures 7, 8

Zoarium a laminar encrustation, up to 1.8 mm. in thickness. Surface with low, broad monticules of somewhat larger zooecia, spaced at intervals of 2.5 to 4 mm. Acanthopores project as short blunt spines.

Zooecia polygonal to rounded in cross section, 11 to 13 occurring in 3 mm. Walls thin and inflected by acanthopores, of which 2 to 5 surround each zooecium. Acanthopores 0.01 to 0.03 mm. in diameter and slightly larger in the walls of the larger zooecia of the monticules, composed of dense tissue with a small lumen. Zooecia occasionally isolated by numerous, large angular and irregular mesopores, but walls generally in contact.

Tubes originate from a wrinkled basal lamina, are prostrate for a short distance, then rise abruptly to the vertical, crossed by nearly straight diaphragms spaced at intervals varying from one-half to 2 tube diameters apart, and lined on one side by a row of vesicular cystiphragms with 11 to 13 vesicles occurring in 1 mm. of tube length. Acanthopores present in longitudinal section as granular streaks enclosing a clear tube. Mesopores originate early in growth and are tabulated by 6 to 12 straight diaphragms in 0.5 mm. or are vesicular in nature in their early portion, with as many as 12 vesicles in 0.5 mm., later changing to possess more widely spaced straight diaphragms. Some mesopores in their early portion have the walls inflected at points of diaphragm insertion and some of the mesopores fail to reach the surface.

Remarks and comparisons.—*Atactoporella bellula* is similar to *A. insueta* Ulrich in size of zooecia but may be distinguished by the smaller number of diaphragms, more regular and smaller vesicle-like cystiphragms and in the closer tabulation of the mesopores.

Locality.—Bromide formation, 136 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48573; portion of holotype in U. S. National Museum.

Genus HOMOTRYPA Ulrich, 1882

HOMOTRYPA CALLITOECHA
Loeblich, n. sp.
Plate 62, figures 18–20

Zoarium ramose, composed of small branches 2 to 3 mm. in diameter. Surface nearly smooth, groups of 3 or 4 zooecia slightly raised into small monticules.

Zooecia polygonal, 13 to 14 in 3 mm., with thick amalgamate walls separated by a light colored granular band and bordered on each side by a thick laminated secondary deposit. Acanthopores poorly defined, present in the junction angles as dark spots. Mesopores few, confined to the monticules.

Tubes in the axial region thin-walled, crossed by straight or slightly oblique diaphragms, spaced at intervals of one to 3 tube diameters. Occasionally the early portion of a tube is closely tabulated, having as many as 5 straight diaphragms in 0.5 mm. of tube length and in rare instances some tubes display a single cystiphragm or a series of 2 or 3 of these in the axial region. Zooecial tubes turned in a gentle curve into the mature region, with true cystiphragms arising in the submature zone, 3 to 4 occurring in 0.5 mm. of tube length in that region. Walls of mature region thicken rapidly in a short distance, appearing fusiform in some cases. Cystiphragms thick, of laminar continuations of the walls. Thin, straight or slightly bent diaphragms occur in the mature region, as closely spaced as 6 in 0.2 mm. of tube length. Walls divided in the mature region by a fine dark crenulated line.

Remarks and comparisons.—*Homotrypa callitoecha* differs from *H. minnesotensis* Ulrich in its smaller monticules, thicker walls, non-oblique apertures, and in the

presence of diaphragms in the axial region.

Locality.—Bromide formation, 225 feet below the top of the formation, in a roadside ditch, west of the Nebo store, sec. 22, T. 2 S., R. 3 E., Arbuckle Mountains, Murray County, Oklahoma.

Types.—Holotype U. C. 48584; portion of holotype in U. S. National Museum.

HOMOTRYPA MULTITABULATA
Loeblich, n. sp.
Plate 63, figures 1–3

Zoarium irregularly ramose or anastomosing, composed of circular branches, 0.7 to 1.6 cm. in diameter, or somewhat flattened branches attaining a width of 4 cm. or more. Surface with small clusters of larger zooecia, only slightly elevated, scattered over the surface at intervals averaging 2.8 mm. apart.

Zooecia polygonal, averaging 13 in 3 mm., walls in contact, with a distinct granular line or band down the middle, marking the original amalgamate wall, bordered by very finely laminated tissue. A few small and indistinct acanthopores, situated in the junction angles of the zooecia, are composed of laminated tissue with a very small lumen. Mesopores rare, except for a few small angular ones among the groups of larger zooecia.

Tubes in the axial region thin-walled and crossed by straight or slightly oblique diaphragms, spaced at intervals varying from one-half to one or slightly more tube diameters apart. As the tubes pass in a gentle curve from the axial region into the submature region, the diaphragms become more oblique, later changing to cystiphragms in the mature region. Walls thicken gradually from the base of the mature zone, and are separated by a crenulated dark line of granular material; cystiphragms continue as laminar linings of the zooecia. Diaphragms in mature region thin, either straight or bent, with as many as 5 occurring in 0.5 mm. of tube length. Cystiphragms line one or at times both sides of the zooecia, with 9 to 11 vesicles in 0.5 mm. of tube length.

Remarks and comparisons.—Specimens from the Sycamore Creek locality have slightly thinner walls than those of the type locality, with an occasional acanthopore indenting the walls, and slightly larger zooecia in the maculae; otherwise the two are very similar.

In growth and size of aperture *H. multitabulata* is similar to *H. subramosa* Ulrich, but it may be distinguished by the small size and almost complete absence of acanthopores, the presence of distinct groups of larger zooecia, and the more regular and closer tabulation in the axial and submature regions.

Locality.—Bromide formation, 200 feet below the top of the formation, at Rock Crossing of Hickory Creek, sec. 35, T. 5 S., R. 1 E., Criner Hills, Oklahoma (type locality); 300 feet below the top of the Bromide formation, on the West Branch of Sycamore Creek, in the northwest one-fourth of sec. 27, T. 3 S., R. 4 E., Arbuckle Mountains, Johnston County, Oklahoma; 140 feet below the top of the Bromide formation, in a road cut on State Highway 99, sec. 12, T. 1 N., R. 6 E., Arbuckle Mountains, Pontotoc County, Oklahoma.

Types.—Holotype U. C. 48574, portion of holotype in U. S. National Museum; paratypes U. C. 48575, 48576, 48578; topotypes and paratypes also in U. S. National Museum.

HOMOTRYPA SAGITTATA
Loeblich, n. sp.
Plate 63, figures 7–9

Zoarium ramose, branches 1 cm. or slightly more or less in diameter. Surface with small elevated monticules, composed of zooecia larger than average, spaced at intervals averaging 2.8 mm.

Zooecia polygonal, 11 to 12 in 3 mm., with walls of medium thickness, amalgamate and separated by a thin granular band, bordered on each side by a laminated secondary deposit. Acanthopores small, composed of laminated dark tissue with a small lumen, one to 5 generally surrounding a zooecium, but not occurring on a great many zooecia. Mesopores few, rare except in the monticules.

Tubes in the axial region thin-walled and crossed by straight or slightly oblique thin diaphragms, spaced at intervals of one to 2 tube diameters, turned in a very gentle curve into the submature zone where the cystiphragms are developed and diaphragms

are slightly more closely spaced. From the submature zone the zooecia turn abruptly to the surface. In some cases a young tube developing in the submature zone may be beaded. Cystiphragms thin in the early mature zone, thickening and continuing as laminar linings of the walls in the more mature areas. Diaphragms thin and straight in the mature zone, 5 to 7 in 0.3 mm. Walls thicken abruptly, longitudinally divided by a strongly crenulated dark granular line.

Remarks and comparisons.—This species is very similar to *H. callitoecha* but may be distinguished by its thinner walls, more prominent aggregates of larger zooecia, slightly more widely spaced diaphragms, and in having a more irregular mature region. It is separated from *H. minnesotensis* Ulrich by the presence of diaphragms in the axial region.

Locality.—Bromide formation, 235 feet below the top of the formation, on Tulip Creek, sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48585; portion of holotype in U. S. National Museum.

HOMOTRYPA ULRICHI
Loeblich, n. sp.
Plate 63, figures 4–6

Zoarium ramose, composed of flattened branches, 5 to 8 mm. in width and 3 to 6 mm. in thickness. Surface with prominent monticules spaced at intervals of 2 mm. or slightly less, as measured from center to center.

Zooecia polygonal, 12 to 13 in 3 mm., with thick, amalgamate walls composed of a medial light granular deposit, bordered on either side by irregular laminated secondary tissue. Walls often indent the zooecial cavity, even where acanthopores do not occur, giving the interior a rugose appearance. Acanthopores small, composed of dark tissue with a small lumen, 1 to 3 surrounding a zooecium, generally occurring in the junction angles, but not present around all zooecia. Mesopores few and small.

Tubes in the axial region with thin, crenulated walls and crossed by straight, oblique or cup-shaped diaphragms spaced at intervals of one-half to 2 tube diameters apart, with an occasional tube being beaded in the early portion. Method of change of direction from the axial region to the mature region varies, may be by a gradual curve or by abruptly turning toward the surface. Tubes may be recurved slightly and even grow downward. Large cystiphragms arise in the submature zone, becoming smaller as the zooecium matures in character; cystiphragms thick, their laminar continuations lining the zooecia, often giving the tubes a vesicular character. Diaphragms straight or slightly bent, as many as 6 occurring in 0.5 mm. of tube length. Walls of mature region varying in width and expanding rapidly, commonly strongly wrinkled in the early part, composed of pinnately arranged laminated tissue separated by an irregular dark granular line.

Remarks and comparisons.—*Homotrypa ulrichi* differs from *H. tuberculata* Ulrich in having thicker and more irregular walls and in possessing diaphragms in the axial region.

Locality.—Bromide formation, 26 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48587; portion of holotype in U. S. National Museum.

Genus MESOTRYPA Ulrich, 1893
MESOTRYPA FAVOSA Loeblich, n. sp.
Plate 63, figures 15, 16

Zoarium of superimposed layers forming a low discoidal mass, 5 cm. or more in width and 1.3 cm. in height. Surface irregular and with low rounded monticules, spaced as closely as 4 mm. from center to center on some parts of the surface, absent on others; low, ridge-like monticules may also occur.

Zooecia varying greatly in size and shape, polygonal to oval in outline, 8 to 9 in 3 mm., with thin, amalgamate walls, consisting of an inner clear granular zone and bordered by fine laminar tissue sharply set off from the former by a dark line; numerous clear beads occur in the walls. Mesopores vary in number, absent in some areas and abundant in others, varying greatly in size and shape.

Tubes arise nearly directly from a wrinkled basal lamina, with thin and very slightly crenulated walls, crossed by straight, cupped, funnel-shaped or oblique thin diaphragms, commonly incomplete, spaced as close as 7 in 0.5 mm. of tube length, although

they may be as much as 2 tube diameters apart, in general more closely spaced in the more mature portions. Mesopores few, crossed by 12 to 14 straight diaphragms, with their walls slightly constricted at points of diaphragm insertion, becoming smaller with age and generally not reaching the surface.

Remarks and comparisons.—*Mesotrypa favosa* is distinguished from *M. quebecensis* (Ami) in possessing a more massive zoarium and in having more polygonally shaped zooecia, which are more closely tabulated throughout.

Locality.—Bromide formation, 275 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48588, portion of holotype in U. S. National Museum.

MESOTRYPA TUBULIFERA Loeblich, n. sp.
Plate 63, figures 17, 18

Zoarium of superimposed layers building an irregular mass, 15 cm. or more in greatest width and 6 cm. or more in greatest thickness, both surfaces irregular and basal one strongly wrinkled, upper surface with small irregular low monticules.

Zooecia generally oval, occasionally polygonal, 8 to 9 in 3 mm., with numerous small, angular mesopores filling the interzooecial space. Walls thin, amalgamate, lined with numerous small clear beads (acanthopores?).

Tubes arise from a basal crenulated lamina directly to the surface, are crossed by straight, oblique, funnel-shaped or incomplete diaphragms, spaced at intervals up to two and one-half tube diameters apart, but generally somewhat less. Mesopores numerous, crossed by 10 to 12 straight diaphragms in 1 mm. of length, either diminishing in size upward and disappearing, or reaching the surface, with a few mesopores being "vesicular" in nature. Diaphragms in mesopores and zooecia continue as laminar linings of these tubes. Walls of zooecial tubes thicken gradually with growth and may be traversed by a small, clear tube, or small clear beads may appear.

Remarks and comparisons.—*Mesotrypa tubulifera* is very similar to *M. favosa* but may be distinguished by its larger, more irregular zoarium, more ovate zooecia, greater number of mesopores and more widely spaced diaphragms. This species is distinguished from *M. quebecensis* (Ami) in having more closely spaced diaphragms and in possessing the peculiar clear beads in the walls.

Locality.—Bromide formation, 235 feet below the top of the formation, on Tulip Creek, sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48589, portion of holotype in U. S. National Museum.

Genus MONTICULIPORELLA Bassler, 1934
MONTICULIPORELLA CRONEISI
Loeblich, n. sp.
Plate 62, figures 6, 7

Zoarium composed of round to wide flattened branches, irregular in width and thickness, up to 2 cm. or over in width and one cm. or less in thickness. Surface with small, slightly raised clusters of larger zooecia.

Zooecia polygonal, 12 to 13 in 3 mm., walls thin, amalgamate, composed of granular tissue with a thin border of an irregular laminated secondary deposit. Acanthopores rarely conspicuous, walls containing numerous darker granular spots. Mesopores few, small and angular, varying in number over the surface.

Tubes in axial region thin-walled, with a slight tendency towards beading in the early portion, crossed by closely spaced straight or bent diaphragms, 6 to 8 in the early portions of the zooecia. Diaphragms become more widely spaced and irregular in arrangement as the zooecia increase in length, those in the mature region are straight or slightly bent, may vary in spacing between one-fifth and over one tube diameter apart, usually more closely spaced in the earliest portion of the mature zone, then rare or lacking for a space of several tube diameters, followed by one to 3 in the latest portion of the tube. Cystiphragms in both axial and mature region, 5 to 7 vesicles lining one side or occasionally both sides in the axial region, generally in long series but lacking in some portions of the tubes in the axial region. In the mature region 6 to 8 small vesicles line one side of the walls. Small mesopores with horizontal partitions occur in the submature zone.

Remarks and comparisons.—*Monticuliporella croneisi* is distinguished from the

associated *M. shideleri* in possessing fewer mesopores, slightly larger zooecia and in having fewer diaphragms in the mature region. In the latter the diaphragms are more regularly arranged throughout the tubes. This species is separated from *M. arborea* (Ulrich) by the presence of mesopores and in lacking the more prominent acanthopores of that species, and in having smaller cystiphragms in the axial region. It is distinguished from *M.? cannonensis* (Ulrich) by the presence of mesopores, thicker walls and smaller cystiphragms.

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48598, portion of holotype in U. S. National Museum.

Monticuliporella peculiaris
Loeblich, n. sp.
Plate 62, figures 1, 2

Zoarium irregularly lobate, giving off short round or oval branches which are 6 to 10 mm. in diameter; surface smooth.

Zooecia polygonal, 10 to 12 occurring in 3 mm., with thin amalgamate walls consisting of a narrow cingulum of irregularly laminate tissue and a medial zone of lighter granular material separating walls of adjacent zooecia. One to 3 large acanthopores, consisting of ring-like laminated tissue having a small lumen, occur around a zooecium, often indenting the walls; numerous small and indistinct granular acanthopores also occur and do not inflect the walls. Under high magnifications the walls appear rugose. Mesopores numerous, small and angular, varying in number over the surface.

In the axial region the zooecia are thin-walled and crenulated, crossed by straight or bent diaphragms spaced at intervals varying from one to slightly more than 3 tube diameters apart; large cystiphragms isolated or in series of 2 to 5 occur in the axial region. Cystiphragms developed more or less in zones, a short series being followed by a long distance in which none occurs. Early portions of tubes more closely tabulated and often walls are inflected at points of diaphragm insertion. Diaphragms thin-walled in mature zone, weakly funnel-shaped, straight, bent or cupped, spaced at intervals of one-third to one tube diameter apart, continuing as zooecial linings; cystiphragms irregular in occurrence, lining one side of the zooecium. Mesopores seldom reach the surface.

Remarks and comparisons.—This species presents certain peculiarities not considered characteristic of the genus. Mesopores are numerous and in addition, numerous acanthopores with definite laminated tissue and clear centers occur. The latter are best visible under a magnification of ×300.

Explanation of Plate 61

Figs. *1, 2—Anolotichia deckeri* Loeblich, n. sp. Holotype, U. C. 48559, from the Bromide formation on Spring Creek. *1*, Longitudinal view, ×20, *2*, tangential view, ×20. (p. 417)

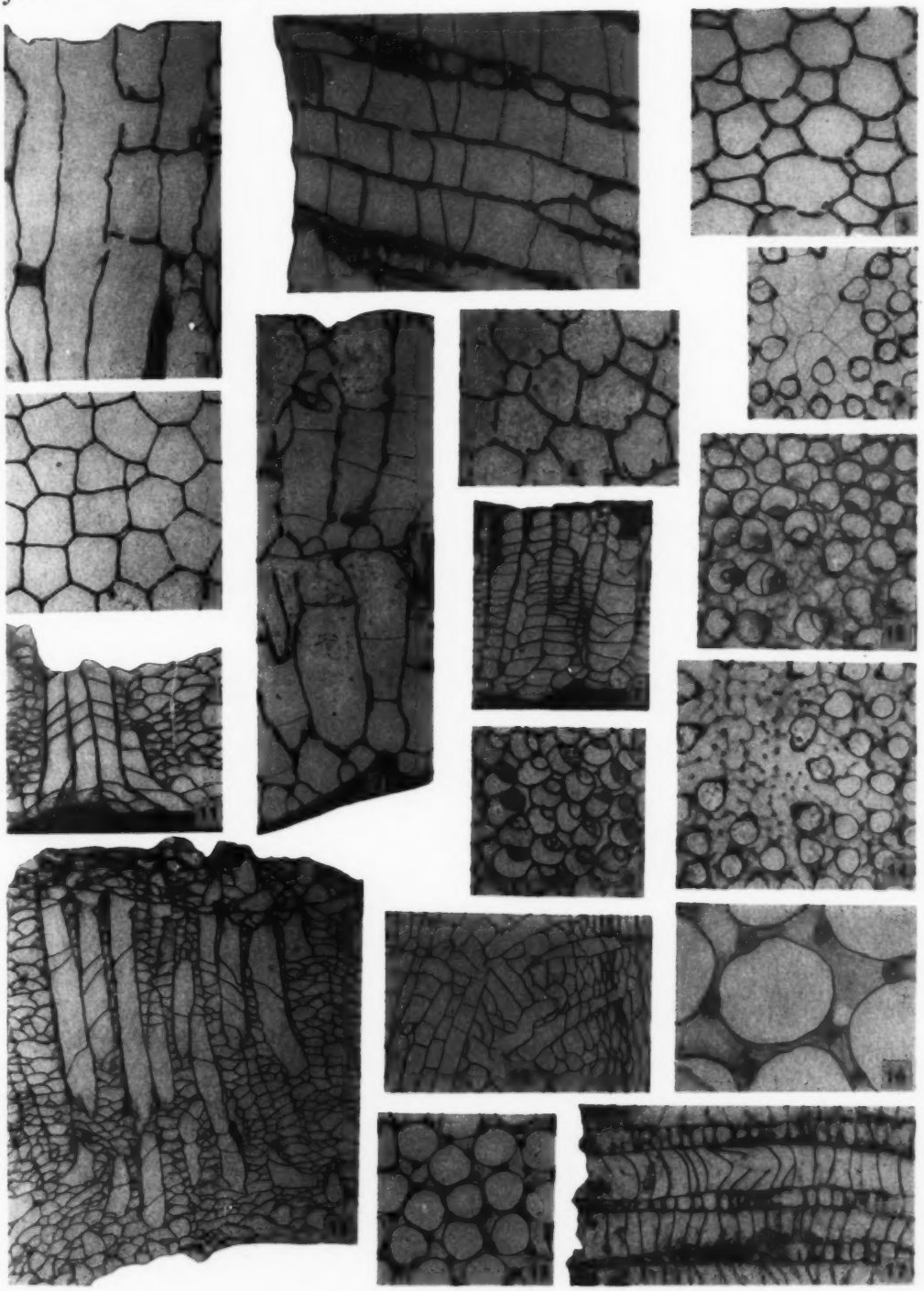
3, 4—Anolotichia spinulifera Loeblich, n. sp. Holotype, U. C. 48558, from the Bromide formation on Spring Creek. *3*, Longitudinal view, ×20, *4*, tangential view, ×20. (p. 418)

5, 6—Anolotichia impolita (Ulrich). Hypotype, U. C. 48557, from the Bromide formation on Spring Creek. *5*, Tangential view, ×20, *6*, longitudinal view, ×20. (p. 418)

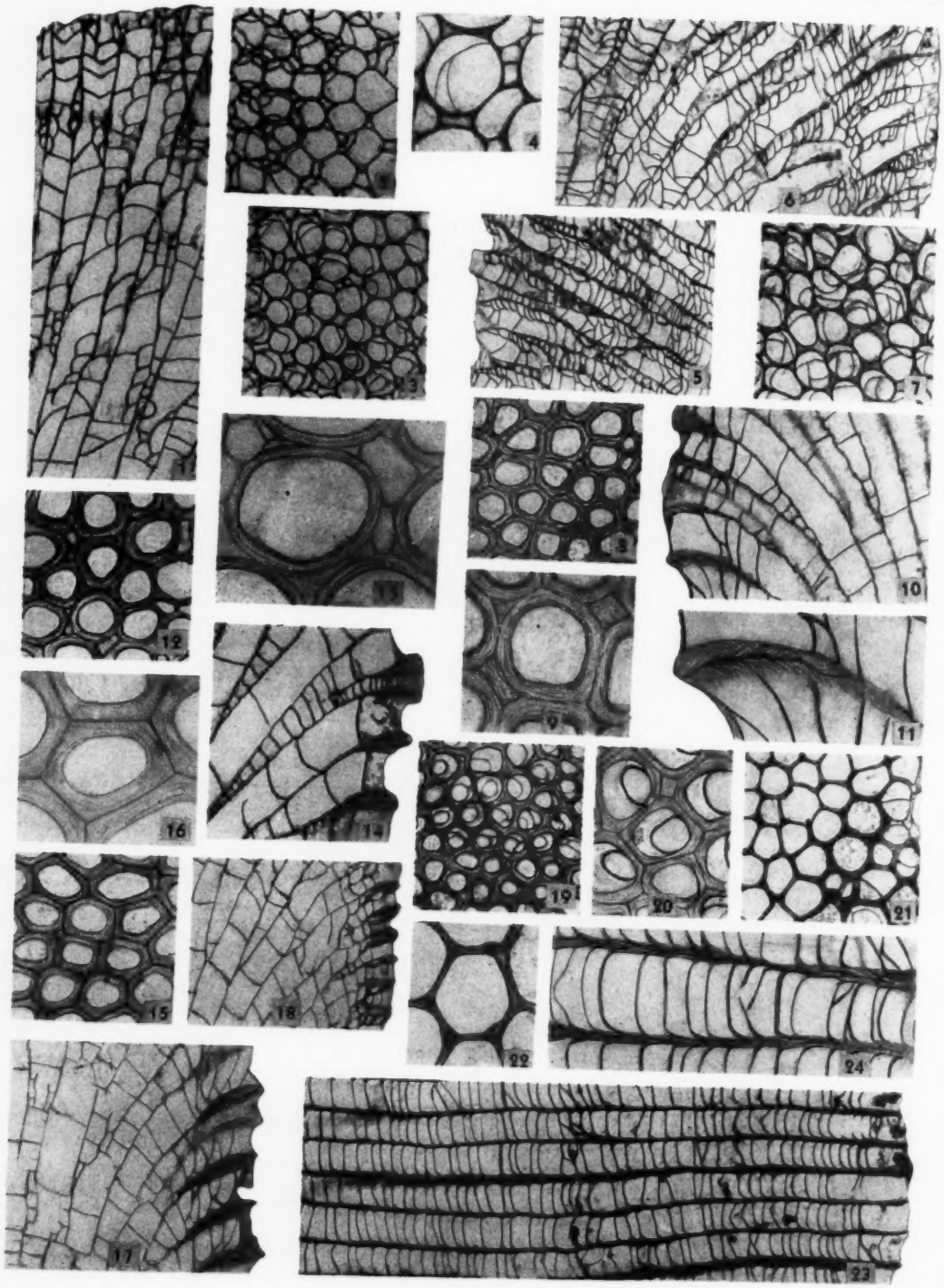
7, 8—Atactoporella bellula Loeblich, n. sp. Holotype, U. C. 48573, from the Bromide formation on Spring Creek. *7*, Longitudinal view ×20. *8*, Tangential view, ×20. (p. 420)

9–14—Fistulipora (?) *bassleri* Loeblich, n. sp. *9*, Tangential view of holotype, an anastomosing erect form, U. C. 48551, from the Bromide formation at Rock Crossing, showing a macula with surrounding zooecia, *10*, longitudinal view of same, *11*, longitudinal section of paratype, U. C. 48556, from the Bromide formation on the West Branch of Sycamore Creek, showing encrusting form of this specimen and vesicular tissue characteristic of the species, *12*, tangential view of same, showing small lunarial pore, *13*, longitudinal view of paratype, U. C. 48554, from the Bromide formation west of the Nebo store, *14*, tangential section of paratype, U. C. 48553, from the Bromide formation at Rock Crossing, showing small inconspicuous lunarial pores and the interstitial pores. All figures ×20. (p. 419)

15–17—Stromatotrypa frondosa Loeblich, n. sp. Holotype, U. C. 48590, from the Bromide formation, on Oklahoma State Highway 99. *15*, tangential view, ×20, *16*, tangential view, ×50. *17*, longitudinal view, ×20. (p. 434)



Loeblich, Ordovician Bryozoa



Loeblich, Ordovician Bryozoa

Monticuliporella peculiaris is distinguished from *M. arborea* (Ulrich) in possessing fewer diaphragms in the mature zone and in lacking the regularity of the cystiphragms in that species.

Locality.—Bromide formation, 125 feet below the top of the formation, on Tulip Creek, sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48597; portion of holotype in U. S. National Museum.

MONTICULIPORELLA SHIDELERI
Loeblich, n. sp.
Plate 62, figures 3–5

Zoarium ramose, of smooth, round to somewhat oval branches, one cm. in thickness and 1.5 cm. or more in width.

Zooecia polygonal to subcircular in outline, 14 to 15 in 3 mm., walls thin, amalgamate, of granular tissue with a very thin darker zone composing the cingulum, bordering the light medial zone. Acanthopores small, indistinct and rare. Mesopores common, small, polygonal, filling the interspaces between the zooecia.

Tubes in axial region with straight, cupped or incomplete diaphragms, spaced as close as 5 to 7 in 0.5 mm. of tube length. Cystiphragms in both immature and mature regions; 5 to 7 vesicles line one side of the wall in the immature zone, arranged in a long series or occasionally isolated, small and regularly arranged or elongate and irregular in arrangement. A few tubes in the axial region have walls inflected at points of diaphragm insertion, producing a beaded appearance for a short distance. Walls in axial region irregular in width, having the appearance of hollow tubes, the borders of darker lines while the centers are clear with cystiphragms as continuations of the walls. Tubes curve gently from the immature to the mature zones with the boundary between the two zones being indistinct. In the mature zone straight, cupped, funnel-shaped or incomplete diaphragms occur, spaced as close as 7 to 8 in 0.5 mm. of tube length and in mesopores generally 8 to 12 straight diaphragms occur in the same length. Cystiphragms in the mature region composed of small vesicles lining one side of the walls, 8 to 9 in 0.5 mm. of tube length. Walls in mature zone irregular in width, crenulated and containing numerous clear granules.

Remarks and comparisons.—*Monticuliporella shideleri* differs from *M. arborea* (Ulrich) in the presence of a greater number of mesopores, smaller acanthopores, and smaller and more irregular cystiphragms in the axial region. It is distinguished from *M.? cannonensis* (Ulrich) by the more numerous mesopores.

EXPLANATION OF PLATE 62

FIGS. *1, 2*—*Monticuliporella peculiaris* Loeblich, n. sp. Holotype, U. C. 48597, from the Bromide formation on Tulip Creek. *1*, Longitudinal view, ×20, *2*, Tangential view, ×20. (p. 424)

3–5—*Monticuliporella shideleri* Loeblich, n. sp. Holotype, U. C. 48591, from the Bromide formation on Spring Creek. *3*, Tangential view, ×20, *4*, tangential view, ×50, *5*, longitudinal view, ×20. (p. 425)

6, 7—*Monticuliporella croneisi* Loeblich, n. sp. Holotype, U. C. 48598, from the Bromide formation on Spring Creek. *6*, Longitudinal view, ×20, *7*, tangential view, ×20. (p. 423)

8–11—*Hallopora dubia* Loeblich, n. sp. Holotype, U. C. 48596, from the Bromide formation on Spring Creek. *8*, Tangential view, ×20, *9*, tangential view, ×50, *10*, longitudinal view, ×20, *11*, longitudinal view, ×50. (p. 430)

12–14—*Hallopora macrostoma* Loeblich, n. sp. Holotype, U. C. 48593, from the Bromide formation on Spring Creek. *12*, Tangential view, ×20, *13*, tangential view, ×50, *14*, longitudinal view, ×20. (p. 430)

15–17—*Hallopora pachymura* Loeblich, n. sp. Holotype, U. C. 48594, from the Bromide formation on Tulip Creek. *15*, Tangential view, ×20, *16*, tangential view, ×50, *17*, longitudinal view, ×20. (p. 431)

18–20—*Homotrypa callitoecha* Loeblich, n. sp. Holotype, U. C. 48584, from the Bromide formation west of the Nebo store. *18*, Longitudinal view, ×20, *19*, tangential view, ×20, *20*, tangential view, ×50. (p. 420)

21–24—*Heterotrypa taffi* Loeblich, n. sp. *21*, Tangential view of holotype, U. C. 48570, from the Bromide formation on Tulip Creek, ×20, *22*, tangential view of same, ×50, *23*, longitudinal view of same, showing small irregular balls of laminated tissue in the zooecial tubes, ×20, *24*, longitudinal view of paratype, U. C. 48571, from the Bromide formation on Spring Creek, showing diaphragms continuing as laminar linings of the zooecia, ×50. (p. 427)

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Oklahoma.

Types.—Holotype U. C. 48591, portion of holotype in U. S. National Museum.

Genus PRASOPORA Nicholson and Etheridge Jr., 1877

PRASOPORA FRITZAE Loeblich, n. sp.

Plate 63, figures 10, 11

Zoarium free, massive, hemispherical in shape, 6 mm. in height and 22 mm. in breadth; surface with small slightly elevated monticules, spaced at intervals of slightly over 3 mm.

Zooecia polygonal, 12 to 14 of the ordinary size in 3 mm., those of monticules being somewhat larger; walls thin, amalgamate, composed of light finely laminated tissue bordering a dark or light granular medial band. One to 2 acanthopores around each zooecium, situated in the junction angles, composed of darker tissue. Walls greatly thickened where acanthopores occur and slightly inflected. Mesopores angular, small, occurring in small aggregates in the monticules, rare elsewhere.

Tubes arise from a wrinkled basal lamina, prostrate for a short distance, then turned abruptly toward the surface. Cystiphragms small, occur throughout the tubes as laminar continuations on both walls, 9 to 10 in 0.5 mm. of tube length, generally in a single series but often overlapping in limited areas. Diaphragms straight, bent or cupped, with as many as 7 in 0.5 mm. of tube length, then absent for a longer distance in the same tube. Acanthopores in longitudinal section appear as clear granular tubes bordered by pinnately arranged laminated tissue. Walls crenulated, separated longitudinally by a dark crenulated line bordered by light laminated tissue.

Remarks and comparisons.—*Prasopora fritzae* is separated from *P. conoidea* Ulrich in possessing fewer mesopores, smaller zooecia and more prominent acanthopores.

Locality.—Bromide formation, 125 feet below the top of the formation, on Tulip Creek, Sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48592, portion of holotype in U. S. National Museum.

Family HETEROTRYPIDAE Ulrich, 1890

Genus DEKAYELLA Ulrich, 1882

DEKAYELLA PRAENUNTIA var. ECHINATA Ulrich

Plate 63, figures 12, 14

Zoarium frondescent, one cm. or more in width and 0.5 cm. or less in thickness. Surface with small, slightly elevated monticules, spaced at intervals of 2 to 3 mm. over the surface, and composed of zooecia only slightly larger than average.

Zooecia polygonal, 11 to 14 in 3 mm., with thick, amalgamate walls composed of a light granular band, bordered on either side by a laminated secondary deposit. Acanthopores with a clear center surrounded by darker rings of tissue, somewhat variable in size, 1 or 2 occurring per zooecium, but not present around all zooecia; the largest and most prominent acanthopores, up to 0.06 mm. in diameter, are aggregated in the monticules; two sizes of acanthopores occur in the junction angles of intermonticular zooecia. In addition, small, dark and poorly defined granular spots may also occur. Mesopores small, few in number.

Tubes in axial region with thin, crenulated walls, tabulated by thin, straight or slightly oblique diaphragms occurring in zones where they are spaced one to 2 tube diameters apart, then generally absent for a long distance. In some cases a young tube displays walls inflected at points of diaphragm insertion, giving a beaded appearance. Zooecial tubes bend in a gentle curve into the mature zone, with diaphragms becoming more numerous and walls thickening rapidly. Young tubes developing in the submature zone often beaded or a single wall in the early mature zone may have a bead. Diaphragms straight or slightly oblique, occasionally incomplete, spaced at intervals of one-half to one tube diameter apart in the mature region. Light colored granular tubes traverse the walls of the mature zone, and are bordered on each side by pinnately arranged laminated tissue, or divided by a dark granular line. Walls of many of the tubes crenulated in the mature region and of irregular width.

Remarks and comparisons.—The Oklahoma specimens are very similar to the types from Minnesota described by Ulrich, in the spacing of the acanthopores and in the

rarity of mesopores, but are slightly more flattened in zoarial form and have slightly thicker walls.

Locality.—Bromide formation, 26 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Hypotype U. C. 48582; portion of hypotype in U. S. National Museum.

Genus HETEROTRYPA Nicholson, 1879
HETEROTRYPA TAFFI Loeblich, n. sp.
Plate 62, figures 21–24

Zoarium ramose, composed of large branches which are circular to ovate in cross section, ranging in width from 1.5 to 2.2 cm. or more, and in diameter from 0.7 to 2 cm. or more. Surface with small, low monticules, spaced at an average interval of 2.8 mm.

Zooecial apertures polygonal, an average of 13 zooecia occurring in 1 mm. in the intermonticular area, slightly larger zooecia in the monticules. Three to 6 ringlike acanthopores, having a small lumen, surround each aperture, those in the monticules being of slightly larger size. Acanthopores situated in the junction angles, inflecting the walls of the zooecia in the monticules, rarely those of the intermonticular zooecia. Walls amalgamate, with a clear or weakly granular band representing the original amalgamate walls and a well-defined laminated cingulum set off from the former by a dark line. Small round bodies, free from the walls, composed of laminated tissue enclosing granular material are observed in tangential section, and the edges of the laminated bent diaphragms appear as cystiphragmlike structures. Mesopores small, essentially confined to the monticules, rare or absent elsewhere.

Zooecial tubes possess thin crenulated walls in the axial region, with horizontal diaphragms apparently arranged somewhat in zones, as they are spaced less than one to 2 or slightly more tube diameters apart, then absent for a long distance in the tube. Tubes change in direction from the axial to the submature zone in a gentle curve, thence into the long mature zone by an abrupt change of direction. Diaphragms become more common in the submature zone, spaced one-half to one tube diameter apart, with an occasional beading of the earlier part of new tubes, diaphragms crowded in the mature zone, 7 to 8 occurring in 0.5 mm. of the most closely tabulated tube length, generally straight or cup-shaped, although occasionally they may be V-shaped, sigmoid or incomplete and projecting downward to touch that last formed.

Diaphragms, under high magnification, are observed to be composed of laminar tissue that continues as laminar zooecial linings. Individual diaphragms vary greatly in thickness, some being exceedingly thin, some much thicker and wedge-shaped, and the diaphragms may split in two, forming two separate entities, or may split and reunite, forming a cystlike receptacle, which is filled with brown granular material. On one diaphragm observed a long spine arises near the center and passes through the next diaphragm above. From the wall of another tube a clavate projection arises, extending diagonally up into the zooecium. In a few tubes small, inward-projecting, hemiphragmlike structures occur, and in one a small, pendunculate ball projects from the wall. In many of the tubes small, irregularly rounded masses of laminated tissue are present, with a darker or reddish center, some lying within a split diaphragm, and in a few instances 10 or more of these small structures are entirely enclosed in an amazingly contorted laminar band of tissue from the zooecial wall.

Remarks and comparisons.—*Heterotrypa taffi* is distinguished from *H. patera* Coryell in possessing a greater number of acanthopores and diaphragms in the mature region, and from *H. stonensis* Coryell by the presence of monticules, greater number of acanthopores and diaphragms in the mature region.

The identity and function of the small bodies included in the zooecia and the small pedunculate balls on the tube walls is not known. They appear in specimens from two different localities and seem to be composed of tissue similar to that of the parent zoarium. In some cases they appear to be restricted to certain growth levels in the zoarium. Whether they represent some sort of "statoblast" or whether they represent parasites upon the bryozoa is not known. They are certainly in some way intimately connected with the zooecia, as the diaphragms are modified to enclose them.

This species is named for Mr. Joseph A. Taff, whose pioneer work in the Arbuckle and Wichita Mountains on the early Paleozoic sediments has laid the foundation for all later studies.

Locality.—Bromide formation, 105 feet below the top of the formation, on Tulip Creek, Sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma (type locality and horizon); 145 feet below the top of the Bromide formation at the same locality as the preceding; 136 feet below the top of the Bromide formation on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48570, portion of holotype in U. S. National Museum; paratypes U. C. 48571, 48572, portions of paratypes also in U. S. National Museum.

Family CONSTELLARIIDAE Ulrich, 1890
Genus NICHOLSONELLA Ulrich, 1889
NICHOLSONELLA IRREGULARIS
Loeblich, n. sp.
Plate 64, figures 5–7

Zoarium ramose, composed of small, round to slightly flattened branches, 3 to 4 mm. in diameter, occasionally irregular in growth. Surface granulose, studded with small blunt spines around the apertures. Macular areas small and indistinct.

Zooecial apertures with ring-like peristomes of laminated tissue, circular to ovate or irregular in outline, 11 to 13 occurring in 3 mm. Irregularity of apertural outline results from indentation by the 5 to 6 acanthopore-like tubes surrounding each zooecium; acanthopores 0.04 to 0.06 mm. in diameter, composed of laminated rings of tissue filled with dark material.

Tubes with thin, slightly crenulated walls in the axial region, occasionally beaded in the early part, with diaphragms rare or absent; zooecial tubes curve gently from the axial into the submature zone; tubes crossed by only a rare complete diaphragm in the mature region, but with small outpushings, or "hemiphragms" commonly projecting inward from the sides, but occasionally pushing outward. Numerous dark granular streaks bordered by clear bands of tissue traverse the mature region in longitudinal sections. Mesopores originate in the submature zone as beaded structures which occasionally do not reach the surface. Four to 5 partitions occur in the early mature area of the mesopores, with the rest of their length obscured by a granular filling.

Remarks and comparisons.—*Nicholsonella irregularis* is similar to *N. moniliformis* but may be distinguished by its less crenulated walls in the axial region, in having both larger acanthopores and the peculiar "hemiphragm-like" projections from the walls; in addition, the zoaria are much smaller and more irregular than those of *N. moniliformis*. This species is distinguished from *N. pulchra* Ulrich in possessing fewer diaphragms in the axial region, beaded mesopores, and in the character of the tabulation of the mature region.

Locality.—Type locality of the Bromide formation, 40 feet below the top of the formation, Sec. 32, T. 1 S., R. 8 E., at the northwest edge of the town of Bromide, in the Arbuckle Mountains, Johnston County, Oklahoma.

Types.—Holotype U. C. 48569, portion of holotype in U. S. National Museum.

NICHOLSONELLA LAMINATA Ulrich
Plate 64, figures 3, 4

Zoarium low and massive, 2 cm. in thickness and 5 cm. in diameter, composed of laminae varying from 1 to 1.5 mm. in thickness. Basal surface strongly wrinkled concentrically.

Zooecia subcircular in outline, 0.44 to 0.64 mm. in diameter, with 4 to 5 occurring in 3 mm., and isolated by angular mesopores. In sections cut near the surface the interzooecial space is filled with a granular-like deposit and perforated by numerous granular acanthopore-like pores. Walls of zooecia and the pores piercing them both granular; the pores may attain a diameter of 0.04 to 0.06 mm. and occasionally indent the zooecial cavity.

Tubes arise from an irregular basal lamella, are prostrate for a short distance, then turned abruptly toward the vertical. Tubes crossed by straight diaphragms spaced at intervals varying from one-half to 3 tube diameters apart. Mesopores originate early in growth and are crossed by an average of 8 straight partitions in one mm.

Remarks and comparisons.—The Bromide forms agree closely with those from the

Decorah of Minnesota in mode of growth, and they are similar internally. However, zoaria from Oklahoma are generaly more robust than those from the Decorah.

Locality.—Bromide formation, in thin limestones 280 feet below the top of the formation, on the West Branch of Sycamore Creek, in the northwest one-fourth of Sec. 27, T. 3 S., R. 4 E., Arbuckle Mountains, Johnston County, Oklahoma.

Types.—Hypotype U. C. 48563, portion of hypotype in U. S. National Museum.

NICHOLSONELLA MONILIFORMIS
Loeblich, n. sp.
Plate 64, figures 1, 2

Zoarium ramose, of dichotomously dividing, round or very slightly flattened branches, varying from 2 to 8 mm. in diameter, according to the maturity of the branches. Surface smooth, the small acanthoporelike spines giving a minutely granulose appearance; small, indistinct maculae also occur.

Zooecial apertures circular to slightly ovate in outline, 11 to 12 occurring in 3 mm., with distinct, thick, ring-like peristomes of irregularly laminated tissue. Zooecia isolated by wide granular interspaces which are perforated by numerous clear acanthoporelike tubes, attaining a diameter of 0.03 mm. In sections, small maculae of granular tissue are also perforated by the numerous small acanthopores.

Tubes in axial region with thin and strongly crenulated walls, early portion commonly beaded, rarely crossed by straight diaphragms, turning in a very gentle curve into the mature region, with beaded mesopores developing in the submature zone and proceeding to the surface. Tubes in early portion of mature zone crossed by thin diaphragms spaced at intervals of from two-thirds to one tube diameter apart, with the mesopores crossed by as many as 6 much thicker partitions in 0.5 mm. Outer mature region obscured by granular deposit; mature region in longitudinal sections traversed by clear or granular streaks, representing the clear acanthopores seen in tangential sections.

Remarks and comparisons.—*Nicholsonella moniliformis* is distinguished from *N. pulchra* Ulrich by its smooth surface, the absence of diaphragms in the axial region and in its characteristic crenulation and beading of the walls. It is distinguished from *N. frondifera* Coryell by zoarial habit, the almost total absence of diaphragms in the axial region, and in its beaded crenulate walls.

Locality.—Bromide formation, 330 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma (type locality); 165 feet below the top of the Bromide formation in a roadside ditch, west of the Nebo store, Sec. 22, T. 2 S., R. 3 E., Arbuckle Mountains, Murray County, Oklahoma; 53 feet below the top of the exposed section of the Bromide formation, in a road cut on State Highway 18, Sec. 11, T. 1 S., R. 3 E., southwest of Sulphur, in the Arbuckle Mountains, Murray County, Oklahoma.

Types.—Holotype U. C. 48568, portion of holotype in U. S. National Museum; paratype U. C. 48567; topotypes U. C. 48566 and in the U. S. National Museum.

Family BATOSTOMELLIDAE Ulrich, 1890
Genus ERIDOTRYPA Ulrich, 1893
ERIDOTRYPA ABRUPTA Loeblich, n. sp.
Plate 63, figures 20, 21

Zoarium ramose, branches 3 to 5 mm. in diameter. Surface with low monticules, spaced at intervals of approximately 2 mm., as measured from center to center.

Zooecia oval to subangular in outline, 6 to 9 in 2 mm., walls thick, ring-like, composed of finely laminated tissue, that of adjoining zooecia separated by a light granular zone. Mesopores common, angular, filling the spaces between the oval zooecia.

Zooecial tubes crossed by remote straight diaphragms, walls thin in the axial region, expanding slowly in width. Zooecia have an abrupt change of direction from the axial region to the mature, as in the submature zone they are nearly vertical. In the short mature region tubes are crossed by one to 4 thick diaphragms that continue as linings of the zooecia. Diaphragms occasionally incomplete and cystiphragm-like in nature. Walls thicken gradually from the submature zone to the surface and longitudinally are divided by an irregular crenulated dark granular line bordered on either side by

laminated tissue. Mesopores originate in the submature zone and are crossed by as many as 7 thick laminated partitions in 0.25 mm. of length.

Remarks and comparisons.—*Eridotrypa abrupta* is distinguished from *E. aedilis* (Eichwald) in lacking the crenulated walls in the axial region and in having diaphragms more widely spaced in that area, in having thicker diaphragms in the mature zone, and in lacking the granular structures as seen in tangential section.

Locality.—Bromide formation, 135 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48595, portion of holotype in U. S. National Museum.

Family HALLOPORIDAE Bassler, 1911
Genus HALLOPORA Bassler, 1911
HALLOPORA DUBIA Loeblich, n. sp.
Plate 62, figures 8–11

Zoarium ramose, composed of round to slightly flattened branches, 4 to 6 mm. in diameter; surface smooth.

Zooecia polygonal, 11 to 13 occurring in 3 mm., walls thick, under low power appearing vaguely integrate, under high magnification observed to be composed of fine laminated tissue separated by a light colored granular zone. Small indistinct acanthopores, lacking a lumen, occur in almost every junction angle, with darker granular lines radiating from them. Mesopores few, small and angular.

Tubes with thin crenulated walls in the axial region attain their full diameter slowly. Diaphragms more closely spaced in the early part, 4 to 5 in 0.5 mm. of tube length, then more widely spaced. In the early part the zooecial walls are slightly inflected at points of diaphragm insertion. Zooecia curve gently from the axial into the mature region, with mesopores developing in the submature zone. In the mature region the diaphragms of zooecia are spaced from less than one-half to one tube diameter apart. Mesopores crossed by straight partitions at the rate of 6 in 0.5 mm. of length, often slightly beaded in the early portion. Walls in mature zone separated by a light or dark granular zone, in a few walls having the appearance of an indistinct crenulated tube, and bordered by pinnately laminated tissue. Diaphragms often incomplete, thick, continuing as laminar linings of the zooecia and of the mesopores.

Remarks and comparisons.—This species possesses numerous acanthopores and has an amalgamate wall, both features which are not characteristic of the genus *Hallopora*. This species differs from *H. angularis* (Ulrich) in having acanthopores, smaller zooecia, and the different wall character.

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48596, portion of holotype in U. S. National Museum.

HALLOPORA MACROSTOMA Loeblich, n. sp.
Plate 62, figures 12–14

Zoarium ramose, of rounded branches, 3 to 4 mm. in diameter, to flattened branches, 12 mm. or less in width and 6 mm. in thickness, arising from a basal expansion which is attached to foreign objects.

Zooecia polygonal to subangular, 7 to 8 in 3 mm., walls thick with ring-like cingulum of finely laminated tissue separated from adjoining zooecial walls by a prominent dark granular line. Occasionally acanthopores occur, composed of dark laminae with an obscure lumen. Mesopores small, angular, filling the interzooecial spaces and never isolating the zooecia.

Tubes in axial region with weakly crenulate walls and straight or slightly bent diaphragms spaced at intervals of one-half to 2 tube diameters apart in mature tubes. In the early part of a tube 5 or 6 diaphragms occur in 0.5 mm. of tube length, followed by a gap, then the diaphragms are more widely spaced. Zooecia are curved gently into the short mature zone with the walls thickening rapidly from the base of the mature zone, becoming clavate in sectional view, separated by a dark crenulated line and bordered by pinnately laminated tissue, with diaphragms continuing as laminar linings of of the zooecia. Diaphragms are spaced from one-third to one tube diameter apart in the mature zone, this region possessing a total of only 1 to 3 diaphragms. Mesopores develop in the submature zone and are tabulated by straight diaphragms, rarely incom-

plete and vesicular in nature, with 7 to 11 partitions in 0.5 mm. of mesopore length.

Remarks and comparisons.—*Hallopora macrostoma* is separated from *H. dumalis* (Ulrich) by its larger zooecia, thicker walls and more diaphragms in the axial region.

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48593, portion of holotype in U. S. National Museum.

HALLOPORA PACHYMURA Loeblich, n. sp.
Plate 62, figures 15–17

Zoarium ramose, of round branches, 3 to 6 mm. in diameter; surface smooth.

Zooecia polygonal, 7 to 9 occurring in 3 mm., walls thick, composed of finely laminated tissue separated by a prominent dark granular line. At the junction angles of the dark separating line occur small triangular clear spots. Mesopores rare, small and angular.

Tubes thin-walled in the axial region, expanding slowly to full width, in early portion closely tabulated, as many as 6 thin diaphragms in 0.5 mm. of tube length, Diaphragms, thickened in mature region and bent or incomplete, are laminar continuations of the walls. Walls of mature region thicken abruptly and are separated longitudinally by a wrinkled dark line, bordered on either side by pinnately laminated tissue.

Remarks and comparisons.—This species is similar in size of tubes to *H. angularis* (Ulrich), but mesopores are fewer and the walls much thicker.

Locality.—Bromide formation, 235 feet below the top of the formation, on Tulip Creek, Sec. 25, T. 2 S., R. 1 E., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48594, portion of holotype in U. S. National Museum.

Family TREMATOPORIDAE Ulrich, 1890
Genus BATOSTOMA Ulrich, 1882
BATOSTOMA CHAPPARSI Loeblich, n. sp.
Plate 64, figures 11–13

Zoarium ramose, composed of round to oval branches, 4 to 5 mm. in diameter; surface smooth.

Zooecia polygonal, 12 to 13 in 3 mm., walls thin, under low magnification observed to be separated by a dark division line which under high power is seen to be a light or dark granular line separating the finely laminated walls. Acanthopores numerous, 2 to 5 surrounding a zooecium, generally occurring in the junction angles, rarely inflecting the walls, composed of darker tissue with an obscure lumen. Mesopores few, small and angular.

Tubes in axial region with thin crenulated walls and straight or slightly bent diaphragms spaced as close as one tube diameter apart, or absent for long distances in a single tube. Early portions of zooecia more closely tabulated with diaphragms often inflecting the walls. Zooecia curve gently from the axial region into the short mature region. Walls thicken rapidly in mature region and diaphragms, cupped, straight, bent or as is more usual, incomplete, are closely spaced, as many as 8 in 0.5 mm. of tube length. Walls in mature region separated by a crenulated dark granular line and bordered by light pinnately laminated tissue. Thick laminated diaphragms of darker material continue as laminar linings of the zooecia, adding to the thickness of the walls.

Remarks and comparisons.—This species differs from *B. winchelli* Ulrich in having fewer diaphragms in the axial and submature zones; otherwise the two are very similar.

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, Sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48599, portion of holotype in U. S. National Museum.

BATOSTOMA CUMINGSI Loeblich, n. sp.
Plate 64, figures 14–16

Zoarium ramose, commonly with a series of overgrowths, forming an irregular mass which obscures the branching. Corners of zooecia studded with small blunt acanthopore spines on the surface.

Zooecia polygonal, ovate to nearly circular in shallow tangential sections, 8 to 10 occurring in 3 mm., with thick heavy walls, in sections cut fairly deep the tubes are thin-walled and strongly polygonal in section. Walls thick, amalgamate, separated by a band of light colored granular tissue and bordered by laminate tissue distinct from the

granular zone. Acanthopores large, up to 0.13 mm. in diameter, with a central lumen surrounded by rings of laminated tissue and dark irregular lines radiating from the center. About 3 to 4 acanthopores surround each zooecium, strongly bulging the walls and constricting the zooecial apertures. Mesopores obscured by a granular deposit in the thick-walled portion of tangential sections, but in deeper regions thin-walled and angular, varying in size and shape.

Tubes in axial region constricted at points of diaphragm insertion in their early part, giving a beaded appearance, with 6 to 7 diaphragms in one mm. of the beaded portion, the thin and slightly crenulate walls expanding gradually in width and crossed by thin, straight, bent or cup-shaped diaphragms, spaced at intervals of one-half to 2 tube diameters apart. Zooecial tubes bent in a gentle curve into the mature region, with walls thickening and diaphragms becoming more closely spaced, at intervals of approximately one-half tube diameter, most abundant in the early and medial portions of the mature region, varying in arrangement from weakly sigmoid to cupped, bent or incomplete and resting on that previously formed; diaphragms continue as laminar linings of the zooecia. In longitudinal section, long tubes filled with a light colored granular material and bordered by a sharp dark line traverse the mature region. Beaded mesopores arise in the submature zone, being tabulated by as many as 7 diaphragms in 0.5 mm. and may not reach the surface, commonly being obscured by a granular deposit.

Remarks and comparisons.—This species is somewhat similar to *Batostoma winchelli spinulosum* Ulrich in the appearance of the acanthopores in tangential sections, but differs in possessing beaded tubes; it is similar to *B. granulosum* Bassler in the beading of the tube walls, but is easily distinguished from the latter by having fewer acanthopores, more diaphragms in the axial and mature regions and in possessing an amalgamate wall, which is not characteristic of the genus *Batostoma*.

Locality.—Bromide formation, 26 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48581, portion of holotype in U. S. National Museum.

Batostoma winchelli Ulrich
Plate 64, figures 8–10

Zoarium of ramose, occasionally anastomosing, slightly flattened branches, 5 to 7 mm. in diameter, being over one cm. wide

---

Explanation of Plate 63

Figs. *1–3—Homotrypa multitabulata* Loeblich, n. sp. *1*, Paratype, U. C. 48576, from the Bromide formation on the West Branch of Sycamore Creek, tangential view, ×20, *2*, tangential view of same, ×50, *3*, longitudinal view of holotype, U. C. 48574, from the Bromide formation at Rock Crossing, ×20. (p. 421)

4–6—Homotrypa ulrichi Loeblich, n. sp. Holotype, U. C. 48587, from the Bromide formation on Spring Creek. *4*, Longitudinal view, ×20, *5*, tangential view, ×20, *6*, tangential view, ×50. (p. 422)

7–9—Homotrypa sagittata Loeblich, n. sp. Holotype, U. C. 48585, from the Bromide formation on Tulip Creek. *7*, Tangential view, ×50, *8*, longitudinal view, ×20, *9*, longitudinal view, ×50, showing laminated wall structure and cystiphragms that continue as laminar linings of the zooecia. (p. 421)

10–11—Prasopora fritzae Loeblich. n. sp. Holotype, U. C. 48592, from the Bromide formation on Tulip Creek. *10*, Tangential view, ×20, *11*, longitudinal view, ×20. (p. 426)

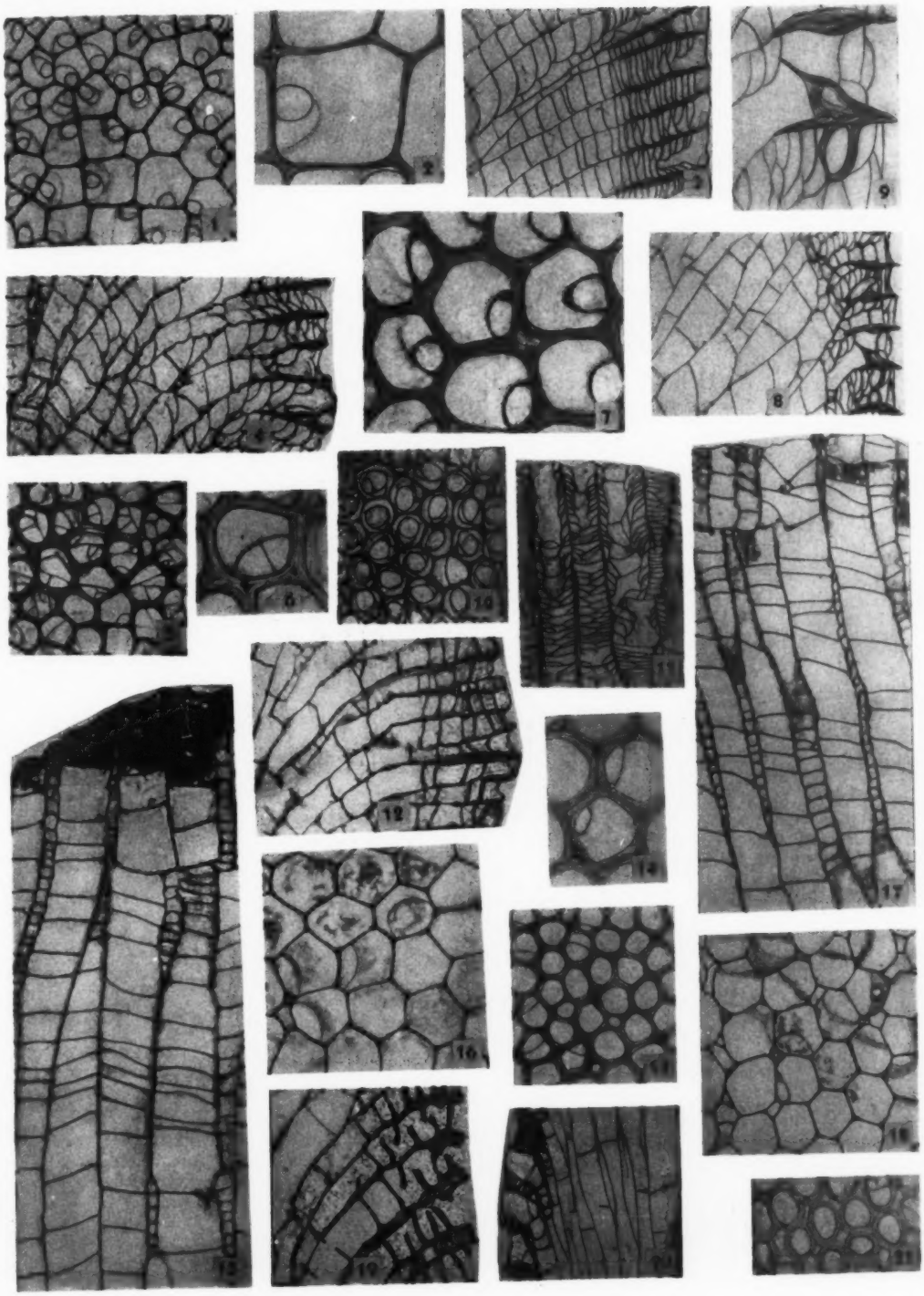
12–14—Dekayella praenuntia var. *echinata* Ulrich. Hypotype, U. C. 48582, from the Bromide formation on Spring Creek. *12*, Longitudinal view, ×20, *13*, tangential view, ×20, *14*, tangential view, ×50. (p. 426)

15, 16—Mesotrypa favosa Loeblich, n. sp. Holotype, U. C. 48588, from the Bromide formation on Spring Creek. *15*, Longitudinal view, ×20, *16*, tangential view, ×20. (p. 422)

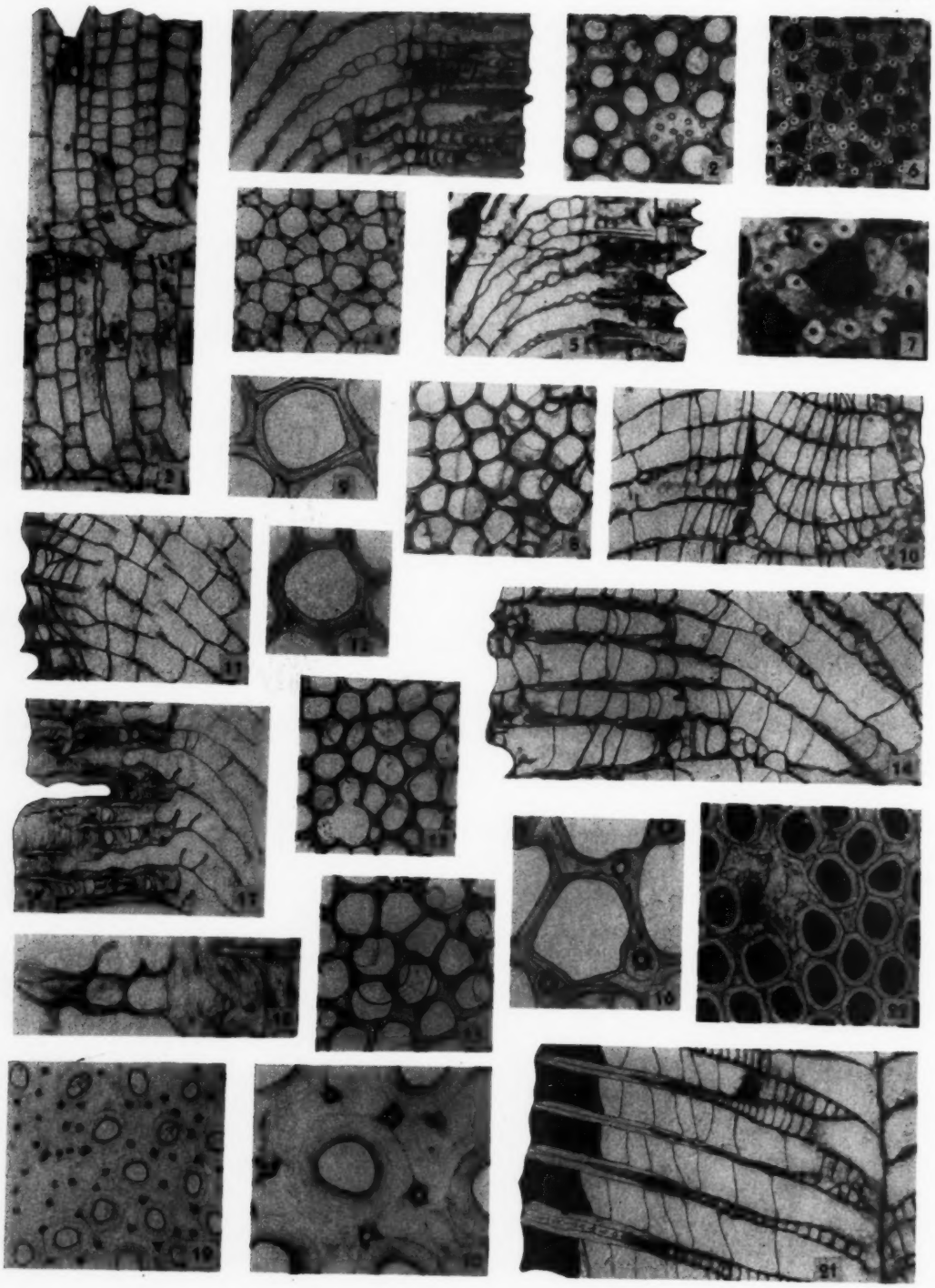
17, 18—Mesotrypa tubulifera Loeblich, n. sp. Holotype, U. C. 48589, from the Bromide formation on Tulip Creek. *17*, Longitudinal view, ×20, *18*, tangential view ×20. (p. 423)

19—Hemiphragma irrasum (Ulrich). Hypotype, U. C. 48562, from the Bromide formation in the Wichita Mountains. Longitudinal view, ×20. (p. 433)

20, 21—Eridotrypa abrupta Loeblich, n. sp. Holotype, U. C. 48595, from the Bromide formation on Spring Creek. *20*, Longitudinal view, ×20, *21*, tangential view, ×20. (p. 429)



Loeblich, Ordovician Bryozoa



Loeblich, Ordovician Bryozoa

at points of anastomosing. Very low and scarcely noticeable monticules, with apertures slightly larger than average, are scattered over the surface. On unweathered surfaces corners of zooecial walls are studded with small spines.

Zooecia polygonal to slightly rounded, 10 to 12 occur in 3 mm., possessing walls of finely laminated tissue, the walls of adjacent zooecia separated by a prominent dark division line, junction angles occupied by a small acanthopore which may be clear or more commonly of darker material; acanthopores rarely inflect the walls. In tangential sections which are cut fairly deep curved cystiphragm like structures are often seen. Mesopores few and of small size.

Tubes in axial region with thin crenulated walls and crossed by diaphragms varying from less than one up to 4 tube diameters apart, with young tubes frequently beaded in their early portion. Zooecial tubes change in direction from the axial to mature regions in a gentle curve, walls become thicker and are crossed by more closely spaced diaphragms, 5 to 7 occurring in 0.5 mm. of mature length. Diaphragms straight, slightly bent, or commonly incomplete, projecting downward to touch that previously formed. Walls with tissue arranged pinnately are split by a dark crenulated fine line. Mesopores originate in the submature zone.

Remarks and comparisons.—The Bromide specimens compare in size and internal characters closely to the forms described by Ulrich from the Decorah of Minnesota.

Locality.—Bromide formation, 25 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Hypotype U. C. 48565, portion of hypotype in U. S. National Museum.

Genus HEMIPHRAGMA Ulrich, 1893
HEMIPHRAGMA IRRASUM (Ulrich)
Plate 63, figure 19

Remarks and comparisons.—This species is extremely rare in the collections studied from the Bromide, being represented by a single fragmentary zoarium. Five hemiphragms occur in 0.5 mm. of tube length in the more closely tabulated portions. An average of 10 zooecia occur in 4 mm. of distance in tangential section.

Locality.—Upper Bromide formation,

EXPLANATION OF PLATE 64

FIGS. *1, 2—Nicholsonella moniliformis* Loeblich, n. sp. *1*, Longitudinal view of holotype, U.C.48568, from the Bromide formation on Spring Creek, ×20, *2*, tangential view of paratype, U. C. 48567, from the Bromide formation on Spring Creek, ×20. (p. 429)

3, 4—Nicholsonella laminata Ulrich. Hypotype, U. C. 48563, from the Bromide formation on the West Branch of Sycamore Creek. *3*, Longitudinal view, ×20, *4*, tangential view, ×20. (p. 428)

5–7—Nicholsonella irregularis Loeblich, n. sp. Holotype, U. C. 48569, from the Bromide formation at the type locality. *5*, Longitudinal view, ×20, *6*, tangential view, ×20, *7*, tangential view, ×50. (p. 428)

8–10—Batostoma winchelli Ulrich. Hypotype, U. C. 48565, from the Bromide formation on Spring Creek. *8*, Tangential view, ×20, *9*, tangential view, ×50, *10*, longitudinal view, ×20. (p. 432)

11–13—Batostoma chapparsi Loeblich, n. sp. Holotype, U. C. 48599, from the Bromide formation on Spring Creek. *11*, Longitudinal view, ×20, *12*, tangential view, ×20, *13*, tangential view, ×50. (p. 431)

14–16—Batostoma cumingsi Loeblich, n. sp. Holotype, U. C. 48581, from the Bromide formation on Spring Creek. *14*, Longitudinal view, ×20, *15*, tangential view, ×20, *16*, tangential view, ×50, showing amalgamate wall on one side of the zooecium, and obscurely integrate wall on adjacent side; also large acanthopores. (p. 431)

17–20—Hemiphragma pulchra Loeblich, n. sp. *17*, Longitudinal view of holotype, U. C. 48560, from the Bromide formation on Spring Creek, ×20, *18*, longitudinal view of paratype, U. C. 48561, from the Bromide formation on Spring Creek, showing character of hemiphragms and tubuli piercing the mature region, ×50, *19*, tangential view of holotype, ×20, *20*, tangential view of holotype, ×50. (p. 434)

21, 22—Pachydictya bromidensis Loeblich, n. sp. Holotype, U. C. 48550, from the Bromide formation in the Wichita Mountains. *21*, Longitudinal view, ×20, *22*, tangential view, ×20. (p. 435)

northwest edge of the Wichita Mountains, in the northwest one-fourth of sec. 14, T. 6 N., R. 16 W., Oklahoma.

Types.—Hypotype U. C. 48562, portion of hypotype in U. S. National Museum.

HEMIPHRAGMA PULCHRA Loeblich, n. sp.
Plate 64, figures 17–20

Zoarium ramose, with subcylindrical branches one cm. or less in diameter, arising from a basal expansion which is generally attached to other bryozoa.

Zooecial apertures sub-circular to elongate-oval in outline, 0.28 to 0.40 mm. in long diameter, including the thick, ring-like walls, which are composed of laminated tissue appearing darker on the inner margins in section. Four to 5 distinct acanthopores, 0.03 to 0.04 mm. in diameter and constructed of darker laminated tissue with a clear center surround each zooecium. Mesopores not observed in tangential section; the interspaces and maculae appear as granular fillings between the laminated walls. The small maculae, containing numerous acanthopores, occur at intervals of 2.8 to 3.6 mm. over the surface, as measured from center to center.

Zooecial tubes in the axial region with thin crenulated walls crossed by few diaphragms or hemiphragms, turning in a gentle curve into the submature zone where prominent hemiphragms or slight outpushings of the walls become more abundant. Mesopores originate in the submature zone, tabulated by straight diaphragms in their early part but becoming filled and obscured in the more mature portion of the zoarium. Walls thicken rapidly from base of mature zone to surface, gradually constricting the apertures. As many as 5 hemiphragms occur in 0.5 mm., but generally the number is somewhat less as the spacing is varied. Hemiphragms and complete partitions are of laminar continuations of the walls. Clear acanthopores traverse the center of the walls in longitudinal sections, with their borders marked by a somewhat darker line, laminar tissue occurring on either side, the downward projecting laminae giving a pinnate appearance.

Remarks and comparisons.—Hemiphragma pulchra differs from *H. irrasum* (Ulrich) in possessing fewer hemiphragms in the axial region, thicker walls and consequently smaller apertures and in having fewer diaphragms in the more mature region; in tangential section the acanthopores of *H. irrasum* (Ulrich) are of larger size than those of *H. pulchra* and occasionally indent the zooecia. Otherwise the two species are very similar.

Locality.—Bromide formation, 26 feet below the top of the formation, on Spring Creek, sec. 17, T. 2 S., R. 1 W., Arbuckle Mountains, Carter County, Oklahoma.

Types.—Holotype U. C. 48560, portion of holotype in U. S. National Museum; paratypes U. C. 48561 and in the U. S. National Museum.

Genus STROMATOTRYPA Ulrich, 1893

STROMATOTRYPA FRONDOSA
Loeblich, n. sp.
Plate 61, figures 15–17

Zoarium of ramose to wide frondescent branches that often anastomose, leaving small fenestrules. Frondescent branches one to 7 cm. or more in width and 2 cm. or over in thickness. Surface with small slightly elevated monticules spaced at intervals of 4 to 5 mm. Acanthopores on the surface project as short spines.

Zooecia subcircular to circular in outline, 9 to 10 in 3 mm., separated from the adjoining zooecia by small angular mesopores, nearly always isolated but may be in contact at numerous points, surrounded by 3 to 5 prominent acanthopores that occasionally indent the walls. Acanthopores, 0.04 to 0.1 mm. in diameter, thick, ring-like, of finely laminated tissue, with darker tissue surrounding the prominent lumen. Zooecial walls thin, of laminated tissue and where in contact appear separated by a light zone of structureless material. Walls of mesopores thin, indistinct under low magnification.

Tubes in the axial region thin-walled, crossed by straight diaphragms spaced as close as one tube diameter apart, with diaphragms in the early part generally inflecting the walls, resulting in a beaded appearance. Tubes turn in a gentle curve into the submature zone where the mesopores and acanthopores originate and diaphragms gradually become more closely spaced. Diaphragms thin and in the mature zone vary greatly in shape, being cupped,

straight, incomplete or even funnel-shaped, 4 to 5 in 0.5 mm. of tube length. Mesopores become slightly smaller as surface is reached, tabulated by thicker straight diaphragms that slightly inflect the walls, 6 to 7 occurring in 0.5 mm. of length. Diaphragms of mesopores and tubes appear as laminar continuations of the walls. Acanthopores present in longitudinal sections as long clear tubes, bordered by pinnately arranged laminated tissue.

Remarks and comparisons.—The wall structure of this species as seen in tangential sections seems to be of an amalgamate nature, which is not characteristic of the family Trematoporidae. *Stromatotrypa frondosa* differs from all described species of the genus in its ramose-frondescent growth. It differs from *S. ovata* Ulrich in possessing smaller zooecia, definite large acanthopores, and more numerous diaphragms in the zooecial tubes; from *S. globularis* Ulrich and Bassler it is distinguished internally by the more numerous acanthopores and by having a greater number of diaphragms that are variable in shape.

Locality.—Bromide formation, 140 feet below the top of the formation, on State Highway 99, sec. 12, T. 1 N., R. 6 E., Arbuckle Mountains, Pontotoc County, Oklahoma (type locality); lower Bromide formation on the McLish Ranch, sec. 24, T. 1 S., R. 7 E., Arbuckle Mountains, Johnston County, Oklahoma.

Types.—Holotype U. C. 48590, portion of holotype in U. S. National Museum; paratypes U. S. National Museum 99443, and in the collection of the writer.

Order CRYPTOSTOMATA Vine, 1883
Family RHINIDICTYONIDAE Ulrich, 1893
Genus PACHYDICTYA Ulrich, 1882
PACHYDICTYA BROMIDENSIS
Loeblich, n. sp.
Plate 64, figures 21, 22

Zoarium consisting of bifoliate frondescent branches, undulating and of irregular width, width varying up to more than 4 cm., branches 2 to 3 mm. in thickness, with rounded margins; surface with slightly elevated maculae.

Zooecial apertures oval, those adjacent to maculae somewhat more rounded and slightly larger than intermacular zooecia, about 0.4 by 0.3 mm. in diameter. Walls thick and ring-like and composed of laminated tissue, those of adjacent zooecia generally in contact, boundaries distinguished by a prominent dark line of granular material. Interstitial space filled by small angular vesicles. Irregular to substellate maculae, appearing solid in sections, occur at intervals of 3 to 3.5 mm., as measured from center to center.

Zooecial tubes arise from a median lamina, diverging at an angle of 71 degrees toward the surface; occasionally a young tube is prostrate for a very short distance. Tubes crossed by 7 or 8 bent diaphragms, varying from one to less than one-third tube diameter apart; diaphragms occasionally incomplete, projecting downward to touch that previously formed, giving a vesicular appearance. Walls composed of very finely laminated tissue and are separated by an irregular dark line of granular tissue.

Interstitial tissue develops early in growth, narrow areas being tabulated by straight diaphragms at the rate of 12 to 16 per mm. and wider zones are generally vesicular in character. The double nature of the median lamina is clearly shown in longitudinal section, transverse sections exhibiting the small tubuli, approximately 0.02 mm. in diameter, between the laminae.

Remarks and comparisons.—This species is similar to *Pachydictya foliata* Ulrich, but may be distinguished by the more closely spaced and bent diaphragms, the absence of the clearly marked tubular character of the zooecial walls, by the more distinct interstitial tissue shown in tangential sections and in possessing a lesser amount of vesicular tissue as shown in longitudinal section.

Locality.—Upper Bromide formation, northwest edge of the Wichita Mountains, in the northeast one-fourth of sec. 14, T. 6 N., R. 16 W., Oklahoma.

Types.—Holotype U. C. 48550, portion of holotype in U. S. National Museum.

REFERENCES

BASSLER, R. S., *1903*, The structural features of the bryozoan genus *Homotrypa*,, with descriptions of species from the Cincinnatian group: *U. S. Nat. Mus. Proc.*, vol. 26, pp. 565–591.

——, *1911*, The early Paleozoic Bryozoa of the Baltic Provinces: *U. S. Nat. Mus. Bull.* 77, 382 pp.

——, *1915*, Bibliographic index of American Ordovician and Silurian fossils: *U. S. Nat. Mus. Bull.* 92, 2 vols., 1521 pp.

——, *1922*, The bryozoa, or moss animals: *Smithsonian Inst., Ann. Rept.*, 1920, pp. 339–380.

——, *1934*, Bryozoa: *Fossilium Catalogus, Animalia*, pt. 67, 229 pp.

—— and KELLET, B., *1934*, Bibliographic index of Paleozoic Ostracoda: *Geol. Soc. America Special Papers* No. 1, 500 pp.

BRIDGE, J., in REESIDE, J. B., JR., *1933*, Stratigraphic nomenclature in the United States: *Internat. Geol. Congress*, xvi session, United States, 1933, Guidebook 29.

CORYELL, H. N., *1921*, Bryozoan faunas of the Stones River group of central Tennessee: *Indiana Acad. Sci. Proc.* 1919, pp. 261–340.

CRAM, I. H., *1932*, Correlation of the eastern Oklahoma Ordovician section with that of the Arbuckle region [abstract]: *Geol. Soc. America Bull.*, vol. 43, no. 1, p. 286.

CUMINGS, E. R. and GALLOWAY, J. J., *1913*, The stratigraphy and paleontology of the Tanner's Creek section of the Cincinnati series of Indiana: *Indiana Dept. Geol., Ann. Rept.*, 37, pp. 353–478.

DAKE, C. L., *1921*, The problem of the St. Peter sandstone: *Missouri Univ. School Min. and Metall. Bull. Tech. ser.*, vol. 6, no. 1, pp. 1–225.

DECKER, C. E., *1930*, Simpson group of Arbuckle and Wichita Mountains, Oklahoma: *Am. Assoc. Petroleum Geologists Bull.*, vol. 14, no. 12, pp. 1493–1505.

—— and MERRITT, *C. A.*, *1931*, The stratigraphy and physical characteristics of the Simpson group: *Oklahoma Geol. Surv. Bull.* 55.

——, *1933*, The early Paleozoic stratigraphy of Arbuckle and Wichita Mountains [abstract]: *Tulsa Geol. Soc. Digest*, pp. 55–57.

——, *1939a*, Two lower Paleozoic groups, Arbuckle and Wichita mountains, Oklahoma: *Geol. Soc. America Bull.*, vol. 50, pp. 1311–1322.

——, *1939b*, Progress report on the classification of the Timbered Hills and Arbuckle group of rocks, Arbuckle and Wichita mountains, Oklahoma: *Oklahoma Geol. Surv., Circular* 22, 62 pp.

EDSON, F. C., *1927*, Ordovician correlations in Oklahoma: *Am. Assoc. Petroleum Geologists Bull.*, vol. 11, no. 9, pp. 967–975.

——, *1929*, Pre-Mississippian sediments in central Kansas: *Am. Assoc. Petroleum Geologists Bull.*, vol. 13, no. 5, pp. 441–458.

——, *1935a*, Guidebook of ninth annual field conference: *Kansas Geol. Soc.*

——, *1935b*, Resumé of St. Peter stratigraphy: *Am. Assoc. Petroleum Geologists Bull.*, vol. 19, no. 8, pp. 1110–1130.

KAY, G. M., *1937*, Stratigraphy of the Trenton group: *Geol. Soc. America Bull.*, vol. 48, pp. 233–302.

LOEBLICH, A. R., JR., *1940*, A fine abrasive for use in thin-sectioning: *Jour. Paleontology*, vol. 14, no. 4, p. 378.

NICKLES, J. M. and BASSLER, R. S., *1900*, A synopsis of American fossil Bryozoa, including bibliography and synonomy: *U. S. Geol. Survey Bull.* 173, 663 pp.

TAFF, J. A., *1903*, *U. S. Geol. Survey Geol. Atlas* (Tishomingo folio: no. 98).

ULRICH, E. O., *1895*, On lower Silurian Bryozoa of Minnesota: *Minnesota Geol. Survey Final Rept.* 3, pt. 1, pp. 96–332.

—— and BASSLER, R. S., *1904*, A revision of the Paleozoic bryozoa, pt. 2, On genera and species of Trepostomata: *Smithsonian Misc. Coll.*, vol. 47, pp. 15–55.

——, *1911*, Revision of the Paleozoic systems: *Geol. Soc. America Bull.*, vol. 22, pp. 281–680.

—— and BASSLER, R. S., *1913*, Bryozoa: *Maryland Geol. Survey Lower Devonian*, pp. 259–290.

——, *1927*, Fossiliferous boulders in the Ouachita "Caney" shale and the age of the shale containing them: *Oklahoma Geol. Survey Bull.* 45, 48 pp.

——, *1929*, Ordovician trilobites of the family Telephidae and concerned stratigraphic correlations: *U. S. Nat. Mus. Proc.*, vol. 76, Art. 21, 101 pp.

——, *1933*, Simpson group of Oklahoma [abstract]: *Geol. Soc. America Bull.*, vol. 44, pt. 1, pp. 105–106.

—— and COOPER, G. A., *1938*, Ozarkian and Canadian Brachiopoda: *Geol. Soc. America Special Papers* no. 13.

WILMARTH, M. G., *1938*, Lexicon of geologic names of the United States: *U. S. Geol. Survey Bull.* 896, 2 pts., 2396 pp.

MANUSCRIPT RECEIVED BY THE EDITOR DECEMBER 23, 1940.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 437–458, PLS. 65–68, JULY 1942

CHESTER BRYOZOA OF ILLINOIS AND WESTERN KENTUCKY[1]

ARTHUR C. McFARLAN
University of Kentucky, Lexington, Kentucky

ABSTRACT.—An attempt is made to make the bryozoa of the Chester Series more available for stratigraphic purposes through the study of 81 collections from the various formations of that series; also to clear up some points of systematic relationships. Few of the species originally assigned to *Fenestella* (now *Fenestrellina*) belong to that genus, but are fragments of the frond of *Archimedes*. An effort is made to identify and classify the species of that genus on the basis of both frond and axis instead of the latter alone. Simpson's *Lyroporella* is recognized as a valid genus. Sixteen new species and varieties are described.

Order CRYPTOSTOMATA
Family FENESTRELLINIDAE
Genus ARCHIMEDES Owen

REPRESENTATIVES of the genus *Archimedes* form the most prolific part of the bryozoan fauna of the Chester, and of the described species the greater number are restricted in their range to this series.

The genus may be defined as a fenestrated expansion of the same character as *Fenestrellina*[2] (i.e., composed of carinated branches bearing a double row of cell apertures), spirally wound, and supported by a solid calcareous, central axis. Fossil specimens usually consist of these calcareous axes, stripped of the delicate frond which occurs as detached fragments scattered throughout the rock and comprises most of the "Fenestelles" of Chester faunal lists.

Differentiation into species has been based on axial characters. In the present work the writer attempts to correlate frond and axis and to differentiate the true *Archimedes* and true "Fenestellas." Axes to which fragments of the frond are still attached are not common.

A study of attached frond fragments shows five general types:

1. *Archimedes invaginatus* type: Characterized by broadly angular branches with strong upward projecting peristomes, faint carina with numerous minute tubercules, and the presence of a single conspicuous though small tubercule on the center of each dissepiment. This last-named feature is the most distinctive.

2. *Archimedes swallovanus* type: Distinguished from the preceding by the absence of the tubercule on each dissepiment.

3. *Archimedes meekanus* type: A type found in *Fenestrellina serratula* and characterized by the narrowly angular branches, small outward projecting peristomes, and the numerous tubercules giving the carina a serrated appearance.

4. Fronds of the *Fenestrellina tenax* type: These differ from the *A. meekanus* type (*F. serratula*) only in the finer fenestration and perhaps should not be separated from that group. Typically there are 25 to 30 fenestrules in 1 cm. instead of ±15 to 20 in that species. There are, of course, many that are intermediate. It is well represented in the new species *Archimedes bassleri*.

5. *Archimedes laxus* type: Characterized by the coarseness of fenestration (12 to 13 fenestrules in 1 cm.). There are from 3 to 4 small tubercules to 1 fenestrule.

Similarly the many axes are grouped under four main types, those within each group differing from each other only in strength of axis, and spacing of the volutions. They include:

1. *Archimedes meekanus* type: Characterized by the conical expansion of the shaft between successive flanges.

2. *Archimedes swallovanus* type: Characterized by the symmetrical curvature of the flanges. Though in many cases directed somewhat upward, particularly in the lower part, the flanges do not show this to the extent of the preceding type.

3. *Archimedes laxus* type: Characterized by the loose spiral coiling of the axis.

[1] This work was originally done in 1919–1922 as a part of a doctor's thesis at the University of Chicago under the direction of Dr. Stuart Weller. With a few exceptions the collections studied had been made by Weller in the course of field work in Illinois and Kentucky. Types are in the collections of Walker Museum.

[2] (= *Fenestella* Lonsdale).

4. *Archimedes terebriformis* type: Characterized by the corkscrew-like shaft.

Numerous species have been described based on axial differences involving only strength of shaft and spacing of volutions. It is suggested that such differences are not of specific importance and are here given varietal standing. Species are recognized on the basis of a combination of one axial type with one frond type. Similar frond types are found on different axial types and vice versa. Some 20 such combinations are possible with the groups recognized. The degree to which these have been developed among known species is indicated in the accompanying chart (table 1). The geologic range of many of the species is not yet well established because of the usual lack of attached fronds.

TABLE 1.—TYPES OF FRONDS AND AXES IN SPECIES OF ARCHIMEDES[3]

Axial type / Frond type	1a *A. invaginatus*	1b *A. meekanus*	2 *A. swallovanus*	3 *A. laxus*	4 *A. terebriformis*
A. invaginatus	*invaginatus*	*invaginatus* var. *meekanoides* var. nov. var. *remotus* var. nov.	*symmetricus* sp. nov.	*parlaxus* sp. nov.	*tortuosus* sp. nov.
A. swallovanus			*swallovanus* var. *lativolvis* var. *intermedius* var. *communis* var. *compactus* var. *confertus* ?		
"*F. serratula*" (*A. meekanus*)	*meekanus* var. *conicus* var. nov.	*meekanus* *meekanus* var. *proutanus* *meekanus* var. *distans*	*wortheni* (Warsaw ls.)	*sublaxus* ?	
"*F. tenax*"	Unnamed	Unnamed	*bassleri* sp. nov.	*laxiformis* sp. nov.	Unnamed
A. laxus				*laxus*	

[3] Although the record is not complete, there seems to be a parallelism in the development of types of fronds and axes, such that within each axial group there are developed the several frond types, and vice versa. The combination of one axial type with one frond type is used here as of specific value.

ARCHIMEDES MEEKANUS (Hall)
Plate 65, figure 18

Fenestella (*Archimedes*) *Meekana* HALL, *1857*, Am. Assoc. Adv. Sci. Proc., vol. 10, p. 178.

Archimedes meekanus ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 578, pl. 63, fig. 4.

Frond.—Fenestrules 13½ to 20 in 1 cm.; narrow, elliptical; length two to three times width. Apertures 22 to 28 in 5 mm., with well-developed peristomes, which slightly indent the fenestrules. Dissepiments depressed, thin, and slightly carinated; width about one-half that of a branch, and one-third to one-fourth the length of a fenestrule. Tubercules small, prominent, averaging two to two and one-half to the fenestrule, and giving the branch a serrated appearance. On the reverse the branches are narrower, dissepiments stronger, and fenestrules comparatively broader.

The frond is essentially that of *Fenestrellina serratula*, the coarser forms corresponding to *F. multinspinosa*. It is open to question whether these species actually exist in the Chester. Moreover, the frond of *Archimedes wortheni*, from the Warsaw, shows these same characteristics of *F. multinspinosa*.

Axis.—There is a series ranging from axes of the type described as *A. proutanus* Ulrich through *A. meekanus* to *A. distans* Ulrich, the distinctions being the spacing of the volutions and the more acute angle at which the frond is given off in those with the more widely spaced volutions. *A. meekanus* is recognized in this paper, and the others relegated to it, as varieties. The separation of the three must be more or less artificial and they are defined by the spacing of volutions as given by Ulrich (1890). All three may be defined as slender axes, the shaft gradually expanding from a diameter of 1 or 2 mm. to a flange several millimeters in diameter. The frond is given off at an angle varying from 45 to 65 degrees. In *A. meekanus* (Pl. 65, fig. 18) there are from 4 to 5 volutions in 2 cm.; in the variety *proutanus* in excess of 5 with 8 in the most closely coiled axis observed. In the variety *distans* (Pl. 65, fig. 17), the number of volutions is less than 4 in the same distance.

ARCHIMEDES MEEKANUS var. CONICUS McFarlan, n. var.
Plate 65, figures 19, 20

An axis similar to that of *A. invaginatus*, differing from *A. meekanus* in its greater thickness. Measurements show 4½ volutions in 2 cm.; shaft 2½ to 3 mm. in diameter. Minute portions of the attached frond appear to be of the *A. meekanus* type with 20 fenestrules in 1 cm., and a little better than 2 tubercules to the fenestrule. The species is based on a few specimens from the Golconda limestone of Randolph County, Illinois.

Occurrence.—Typical *A. meekanus* and the variety *distans* have their best development in the higher formations of the Chester. The variety *proutanus* has a similar distribution but is less common. *A. meekanus* var. *conicus* has been identified in limited numbers in the Paint Creek, Golconda and Menard.Identification of any of these forms in the lower Chester must be based on both frond and axis due to the common occurrence there of the similar *A. invaginatus* and the variety *meekanoides.*

ARCHIMEDES SWALLOVANUS (Hall)
Plate 65, figures 24, 25

Fenestella (Archimedes) Swallovana HALL, *1857*, Am. Assoc. Adv. Sci. Proc., vol. 10, p. 178.

Archimedes swallovanus ULRICH, *1890*, Illinois Geol. Survey vol. 8, p. 574, pl. 63, figs. 12–12d.

Archimedes swallovanus, KEYES, *1894*, Missouri Geol. Survey, vol. 5, p. 26.

Fenestrules 14 to 19 in 1 cm., elliptical, indented by the zooecia, length two to three times width. Branches broadly angular, 20 to 24 in 5 mm. with prominent upward projecting peristomes, which when well preserved give to the branches a rounded appearance. Carina distinct only in well weathered specimens. Tubercules minute, 2½ to 3 to the fenestrule. Dissepiments depressed, rounded, one-half to two-thirds the strength of the branches, and usually about one-third the length of the fenestrules.

The frond is not unlike that of *Archimedes invaginatus*, differing in lacking the tubercule on each dissepiment. From the frond of *Archimedes meekanus* it differs in the more broadly angular branches with upward projecting peristomes, and the more numerous and much smaller tubercules. It is doubtful that worn examples can be distinguished.

The axis has 4 to 5½ volutions in 2 cm. The frond is given off at right angles or nearly so. In different specimens the shaft varies from 1½ to 6½ mm. in diameter. The distinctive axial feature is in the symmetrical coiling of the flanges. The several varieties are based on the spacing of the volutions and strength of the axis.

ARCHIMEDES SWALLOVANUS var. INTERMEDIUS Ulrich
Plate 65,figure 23

Archimedes intermedius ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 574, pl. 63, fig. 2c.

The axis is intermediate in character between *A. swallovanus* and the var. *communis*. Volutions vary from 5½ to 7 in 2 cm. The shaft varies from 1½ to 4 mm., and the flange from 3 to 5 mm. in diameter.

In the type the frond has 25 apertures in 5 mm., but in other examples these number 22 to 23.

Occurrence.—Axes of this type are known from the Paint Creek to the Menard, with their maximum development in the Glen Dean and Menard. Positive identification has been made in the Golconda, Glen Dean, and Menard formations.

ARCHIMEDES SWALLOVANUS var. COMMUNIS Ulrich
Plate 65, figure 22

Archimedes communis ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 573, pl. 63, figs. 1–1d.

A delicate and rather compact form with 7 to 8½ volutions in 2 cm. The shaft varies from 1 to 2+ mm., and the flanges 3 to 5 mm. in diameter.

Occurrence.—Best developed in the lower formations but it occurs as high as the Menard.

ARCHIMEDES SWALLOVANUS var. COMPACTUS Ulrich
Plate 65, figure 21

Archimedes compactus ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 572, pl. 63, figs. 2–2b, 2d.

This variety is the most delicate and compact form of the species. Volutions number 9 to 11 in 2 cm. The flanges show a greater tendency to turn upward than in *A. swallovanus* var. *communis*. The number of tubercules to the fenestrule tends also to be smaller.

Occurrence.—A good index fossil for the Renault and Paint Creek formations in Illinois and the region of Caldwell, Crittenden, and Livingston counties, Kentucky, (though known as high as the Glen Dean). Stouder (1938, p. 278), however, found it an excellent guide fossil for the Golconda in Meade and Breckinridge counties, Kentucky, and vicinity on the opposite side of the coal basin.

EXPLANATION OF PLATE 65

Figures ×1, except where otherwise indicated

FIGS. *1, 2—Archimedes invaginatus* Ulrich. *1*, Axis with frond attached; *2*, a portion of the frond ×3½, W. M. 28116, Renault limestone, three miles east of Waterloo, Monroe County, Illinois. (p. 441)

3–7—Archimedes invaginatus var. *meekanoides*, McFarlan, n. var. *3*, Holotype, axis with small pieces of frond attached, W. M. 28115: *4*, W. M. 28175. Paint Creek formation, six miles south of Vienna, Johnson County, Illinois; *5*, *6*, W. M. 28236, Paint Creek formation, seven miles southeast of Princeton, Caldwell County, Kentucky; *7*, Golconda formation, two and one-fourth miles northeast of Princeton, Caldwell County, Kentucky. (p. 442)

8–10—Archimedes invaginatus var. *remotus*, McFarlan, n. var. *8*, Holotype, W. M. 28237; *9*, *10*, W. M. 28238, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky. (p. 442)

11—Archimedes tortuosus, McFarlan, n. sp. W. M. 28239, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky. (p. 442)

12, 13—Archimedes symmetricus, McFarlan, n. sp. *12*, W. M. 28233, *13*, holotype, W. M. 28134, Paint Creek limestone, four miles southeast of Princeton, Caldwell County, Kentucky. (p. 442)

14—Archimedes laxiformis, McFarlan, n. sp. W. M. 28125, Okaw limestone, two miles southwest of Ruma, Randolph County, Illinois. (p. 443)

15, 16—Archimedes parlaxus, McFarlan, n. sp. W. M. 28240, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky; *16*, holotype. (p. 442)

17—Archimedes meekanus var. *distans* Ulrich. Axis with frond, W. M. 28146, middle Menard limestone, Blanchard Place, three and one-half miles north of Golconda, Pope County, Illinois. (p. 438)

18—Archimedes meekanus (Hall). W. M. 28230. Small fragments of the frond are attached. Associated axes of the same type bear the *A. invaginatus* frond. Paint Creek limestone, four miles southeast of Princeton, Caldwell County, Kentucky. (p. 438)

19, 20—Archimedes meekanus var. *conicus*, McFarlan, n. var. W. M. 28142, Golconda limestone, one-third mile northwest of Marigold, Randolph County, Illinois. (p. 439)

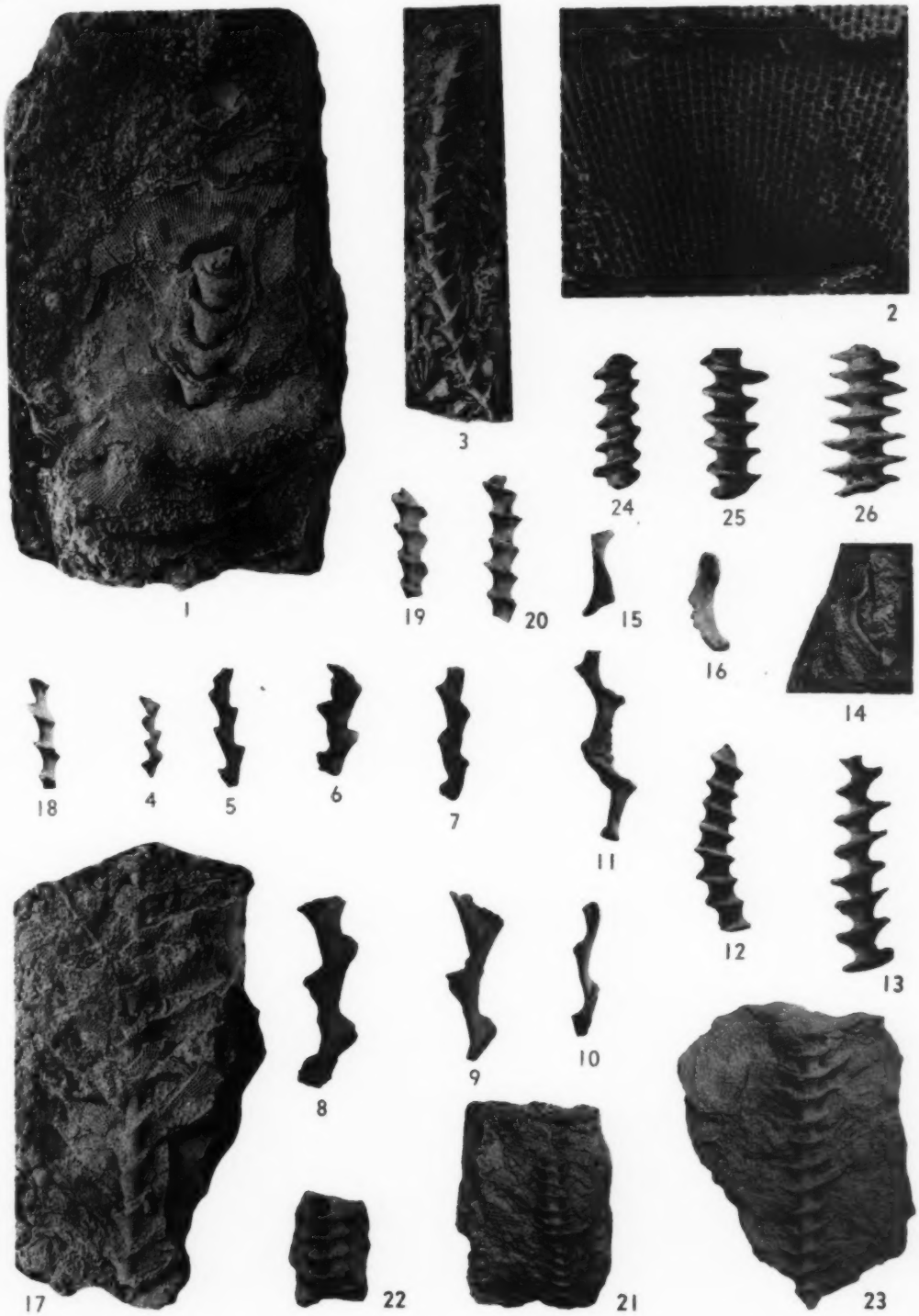
21—Archimedes swallovanus var. *compactus* Ulrich. W. M. 28176, Paint Creek limestone, six miles south of Vienna, Johnson County, Illinois. (See Ill. Geol. Surv., Bull. 41, 1920, pl. 7, fig. 31). (p. 440)

22—Archimedes swallovanus var. *communis* Ulrich. Menard limestone, Blanchard Place, three and one-half miles north of Golconda, Pope County, Illinois. (p. 440)

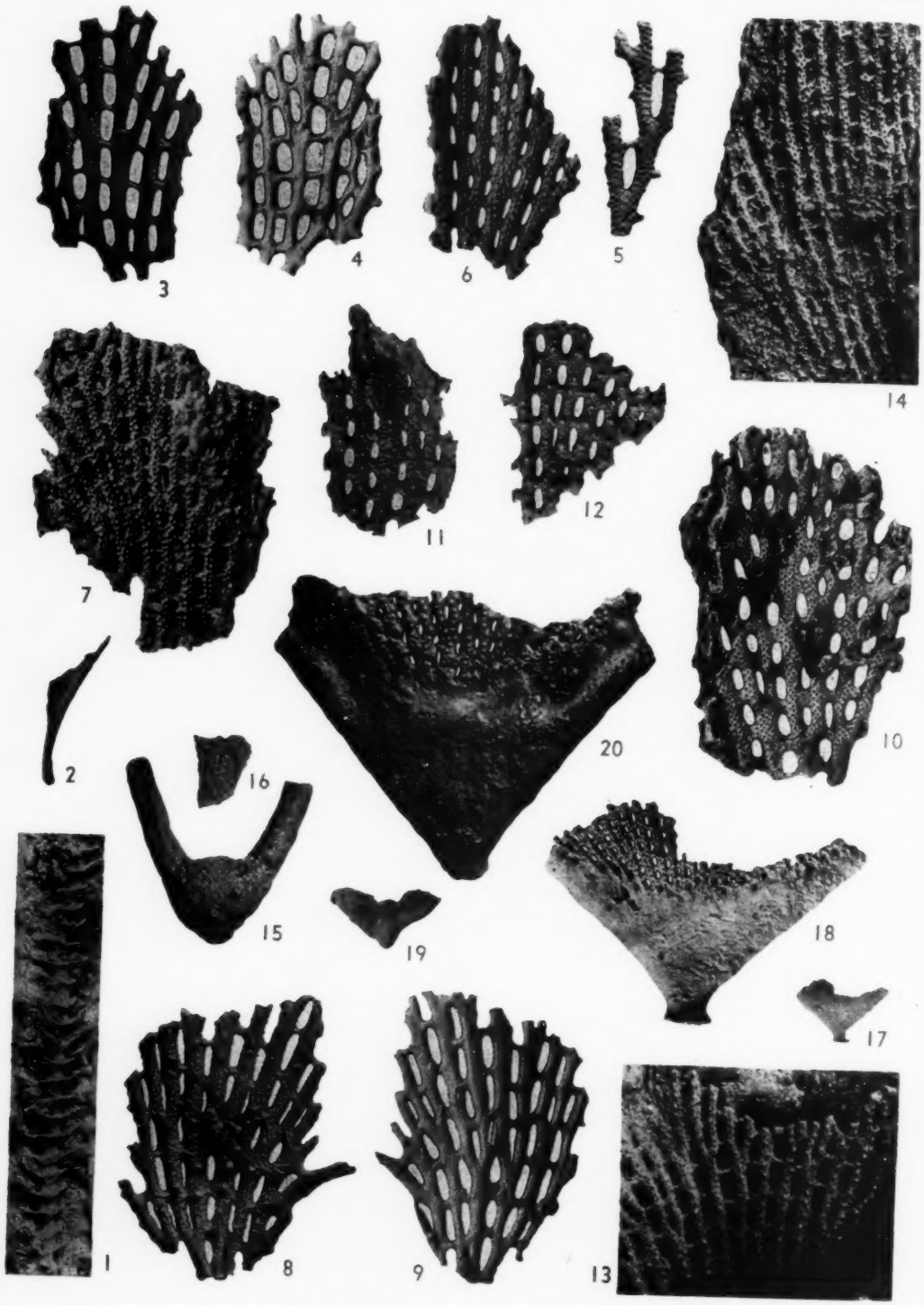
23—Archimedes swallovanus var. *intermedius* Ulrich. U. S. National Museum, Glen Dean limestone, Sloan's Valley, Pulaski County, Kentucky. (p. 439)

24, 25—Archimedes swallovanus Hall. W. M. 28139, Golconda limestone, one mile northwest of Marigold, Randolph County, Illinois. (p. 439)

26—Archimedes swallovanus var. *lativolvis* Ulrich. W. M. 28141, Golconda limestone, one mile northwest of Marigold, Randolph County, Illinois. (p. 441)



McFarlan, Chester Bryozoa



McFarlan, Chester Bryozoa

ARCHIMEDES SWALLOVANUS var. LATIVOLVIS Ulrich

Plate 65, figure 26

Archimedes lativolvis ULRICH, *1905*, U. S. Geol. Survey Prof. Paper 36, pl. 4, fig. 4.
Archimedes lativolvis, BUTTS, *1917*, Kentucky Geol. Survey ser. 4, pl. 23, fig. 10.

There are included here those forms differing from the more robust specimens of *A. swallovanus* in the closer spacing of the volutions and the commonly wider flanges. The number of volutions varies from 6 to 7 in 2 cm., the shaft 3 to 5 mm., and the flanges 6 to 12 mm. in diameter.

Occurrence.—Rather common in and characteristic of the Golconda. The type of axis has also been recognized, though it is not common, in the Paint Creek and the Glen Dean.

ARCHIMEDES INVAGINATUS Ulrich

Plate 65, figures 1–2

Archimedes invaginatus ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 575, pl. 63, figs. 11a, 11c.

Fenestrules 13 to 19 in 1 cm., elliptical, length two to three times the width. Branches strong, broadly angular, carina conspicuous only in weathered material. Tubercules usually very small, 2 to 3½ to the fenestrule, in some specimens somewhat stronger and fewer. Apertures 22 to 24 in 5 mm., with prominent upward projecting peristomes which indent the otherwise elliptical outline of the fenestrules, and give to the well preserved branch a rounded appearance. Dissepiments slightly depressed, rounded, width one-half to two-thirds the width of the branches and two-fifths to three-fifths the length of the fenestrules, and

---

EXPLANATION OF PLATE 66

Figures ×1, except where otherwise indicated

FIGS. *1—Archimedes bassleri*, McFarlan, n. sp. Holotype, W. M. 28105, Clore limestone, Macs Creek Hill, five and three-fourths miles northeast of Vienna, Johnson County, Illinois. (p. 443)

2—Archimedes laxus Hall, W. M. 14432, R. S. Bassler Collection, Glen Dean, Chester, Illinois. (p. 442)

3–7—Polypora multispinosa, McFarlan, n. sp. *3, 4*, Obverse and reverse of holotype, ×3½, W. M. 28249; *5*, paratype, ×3½, W. M. 28250, Paint Creek formation, seven miles southeast of Princeton, Caldwell County, Kentucky; *6*, a variety differing from the typical form in the *P. corticosa* and *P. spinulifera* type of dissepiment and fenestrule, obverse, ×3½, W. M. 28117, Renault limestone, three miles east of Waterloo, Monroe County, Illinois; *7*, a variety with narrowly rounded branches and stronger tubercules, obverse, ×3½, Glen Dean limestone, one-fourth mile northwest of Preston, Randolph County, Illinois. (p. 445)

8, 9—Polypora nodolinearis, McFarlan, n. sp. Obverse and reverse of holotype, ×3½, W. M. 28251, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky. (p. 445)

10—Polypora corticosa Ulrich. Obverse, ×3½, W. M. 28217, Menard limestone, Walche's Cut on the Louisville and Memphis branch of the Illinois Central Railroad, five miles southeast of Princeton, Caldwell County, Kentucky. (p. 446)

11, 12—Polypora approximata Ulrich. Obverse, ×3½, W. M. 28170, Clore limestone, three and one-half miles east of Chester, Randolph County, Illinois. (p. 446)

13—Polypora cestriensis Ulrich. Obverse ×3½, Clore limestone, Macs Creek Hill, five and three-fourths miles northeast of Vienna, Johnson County, Illinois. (p. 446)

14—Polypora tuberculata Prout. Obverse, ×3½, W. M. 28218, Menard limestone, Walche's Cut on the Louisville and Memphis branch of the Illinois Central Railroad (Claxton Station vicinity), five miles southeast of Princeton, Caldwell County, Kentucky. (p. 445)

15, 16—Lyropora ranosculum Ulrich. Base and a portion of the frond, natural size. Syntypes from the collection of the United States National Museum, Glen Dean limestone, Sloan's Valley, Pulaski County, Kentucky. (p. 447)

17, 18—Lyroporella divergens Ulrich. Holotype, natural size and ×3½, collection of the United States National Museum, Glen Dean limestone, Sloan's Valley, Pulaski County, Kentucky. (p. 449)

19—Lyropora plana, McFarlan, n. sp. Holotype showing base and portion of frond, ×1, W. M. 28158, Paint Creek formation, one and one-fourth miles northwest of Floraville, St. Claire county, Illinois. (p. 448)

20—Lyropora subquadrans (Hall). Zoarium showing obverse of frond, ×3½. W. M. 12986, Chester Group, Chester, Illinois. (p. 447)

bearing centrally a small but conspicuous tubercule.

On the reverse the branches are narrow, and about equal in width to the dissepiments. The latter are rounded and not depressed. Fenestrules rounded to subpolygonal.

Axis strong, volutions regular, varying from 3 to 5 in 2 cm. Shaft comparatively slender just above the flange (diameter 2½ to 4 mm.) expanding upward to a diameter of 6 to 9 mm., each volution conical, giving to the axis the appearance of a series of invaginated cones.

The frond is distinguished by the central tubercule on each dissepiment. In other respects it is essentially that of *Archimedes swallovanus*. Though normally a more robust form, the axis in its variations is much like that of the *Archimedes meekanus* series.

Occurrence.—Very common in and characteristic of the Renault and Paint Creek formations. Ulrich has identified it from several Glen Dean localities (perhaps the axis alone) and the writer has identified it in a collection questionably referred to the Golconda by Stuart Weller.

ARCHIMEDES INVAGINATUS var. REMOTUS
McFarlan, n. var.
Plate 65, figures 8–10

The axes show less than 3 volutions in 2 cm., and vary in strength from the *A. invaginatus* type to that of *A. meekanus*. Shaft 1 to 3 mm. and flange 3 to 7 mm. in diameter.

Occurrence.—Paint Creek limestone from several localities in western Kentucky.

ARCHIMEDES INVAGINATUS var. MEEKANOIDES
McFarlan, n. var.
Plate 65, figures 3–7

A variety proposed for those forms with the typical *A. invaginatus* frond but with the more slender axes of the *A. proutanus*, *A. meekanus*, and *A. distans* types. Volutions 3 to 5 in 2 cm., shaft 1 to 1½ mm., and flange 3 to 7 mm. in diameter.

Occurrence.—Common in the Renault and Paint Creek formations.

ARCHIMEDES TORTUOSUS
McFarlan, n. sp.
Plate 65, figure 11

The material studied for this species is not particularly satisfactory. It has the widely spaced volutions of the preceding variety but in the more tortuous course of the volutions is more suggestive of the species *Archimedes terebriformis*. The frond is the same as in *A. invaginatus*.

Occurrence.—Paint Creek limestone.

ARCHIMEDES PARLAXUS
McFarlan, n. sp.
Plate 65, figures 15, 16

The material is fragmentary and neither satisfactory nor abundant. The frond is of the *A. invaginatus* type and is borne by what appear to be axes of the *A. laxus* type.

Occurrence.—Paint Creek limestone from near Princeton, Kentucky.

ARCHIMEDES SYMMETRICUS
McFarlan, n. sp.
Plate 65, figures 12, 13

Frond of the type of *A. invaginatus*. Axis of the *A. swallovanus* and variety *intermedius* type. Shaft 2½ to 3 mm., flange 5½ to 9 mm. in diameter. Volutions 3½ to 5½ in 2 cm.

Occurrence. — Known throughout the Chester but with maximum development in the Menard and Clore.

ARCHIMEDES LAXUS (Hall)
Plate 66, figure 2

Fenestella (Archimedes) laxa HALL, *1857*, Am. Assoc. Adv. Sci. Proc., vol. 10 p. 178.
Archimedes laxus, ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 580, pl. 63, figs. 15, 15a.

Fenestrules 12 to 13 in 1 cm., elliptical, length two to three times the width. Branches narrowly angular, 19 to 21 in 1 cm. Tubercules small, 3 to 4 to the fenestrule. Apertures 21 to 25 in 5 mm. Dissepiments depressed, varying in strength from two-thirds to almost equal to the branches, and from two-fifths to one-half the length of the fenestrules. Other features undeterminable in the available specimens.

On the reverse the fenestrules are broader and more angular, the branches narrowly rounded, and the dissepiments not depressed.

The axis is essentially the thickened edge of a spirally wound frond, each volution completed in 2½ or more cm.

The axis is distinctive. The frond characters are essentially those of *Fenestrellina cestriensis* Ulrich.

Occurrence.—Characteristic of and locally very common in the Glen Dean for which it is a valuable index fossil, but it is not uncommon in the Golconda in Warren, Butler, and Edmonson counties, Kentucky. It has been reported also from the Paint Creek by Ulrich, but the axis alone may have been observed (see *A. parlaxus*).

Archimedes sublaxus Ulrich

Archimedes sublaxus Ulrich, *1890*, Illinois Geol. Survey, vol. 8, p. 579, pl. 63, fig. 14.

The axis differs from that of *A. laxus* in the closer spacing of the volutions, each being completed within about 1 cm. The shaft has a diameter of 1 to 1½ mm. spreading slowly upward into a flange with diameter of about 5 mm. The frond diverges at an angle of about 40 degrees.

As described by Ulrich the frond has 16 fenestrules, and 22 to 23 branches in 1 cm., and about 26 apertures in 5 mm.

Occurrence.—Associated with *A. laxus* and equally characteristic of the Glen Dean formation.

Archimedes terebriformis Ulrich

Archimedes terebriformis Ulrich, *1890*, Illinois Geol. Survey, vol. 8, p. 575, pl. 63, figs. 5–5c.

Axis with 3 to 4 volutions in 2 cm., shaft with diameter of 1 to 2½ mm., distinctly spiral, and thickened just below the flange. Frond given off at an angle of about 60 degrees. Nature of the frond not known. The axis is characterized by its corkscrew-like course and the swelling of the shaft just below the flange.

Occurrence.—Axes of this type range from the Paint Creek to Menard formations, apparently being most common in the Middle Chester.

Archimedes confertus Ulrich

Archimedes confertus Ulrich, *1905*, U. S. Geol. Survey Prof. Paper 36, pl. 4, figs. 6–8.

Axis of the *A. swallovanus* type, characterized by the very close spacing of the volutions and broad flanges. The nature of the frond is not known. The axis is strong, with 8 to 11 volutions in 2 cm., the shaft 1½ to 4 mm., and the flanges 5 to 8 mm. in diameter. Frond given off at an angle of about 80 degrees.

Occurrence.—This species is not common and has been identified by the writer in the Paint Creek and Golconda. It is characteristically developed according to Butts (1918, p. 80) in the uppermost Gasper (Paint Creek).

Archimedes perminimus Ulrich

Archimedes perminimus Ulrich, *1890*, Illinois Geol. Survey, vol. 8, p. 572, pl. 63, figs. 13, 11 (in part).

A very small axis, minute in all of its features, similar to *A. terebriformis* in its manner of coiling. The volutions number 4 in 5 mm. (16 in 2 cm.) and the diameter of the shaft does not exceed 0.25 mm.

Occurrence.—Exact occurrence within the Chester not known.

Archimedes bassleri
McFarlan, n. sp.
Plate 66, figure 1

Archimedes bassleri is a species characterized by a combination of the *A. swallovanus* type of axis with the *Fenestella tenax* type of frond. Volutions 4½ to 7½ in 2 cm., diameter of shaft 2½ to 3 mm., and diameter of flanges 5 to 10 mm. The axis thus varies from the type of *A. swallovanus* to the variety *intermedius*.

The frond has 26 to 28 fenestrules, and 28 to 30 branches in 1 cm., 22 to 28 zooecia in 5 mm., and from 2½ to 3 tubercules to the fenestrule. Measured specimens suggest a trend toward a closer spacing of the apertures in the higher horizons.

Occurrence.—Rather common in the Glen Dean, Menard and Clore formations.

Archimedes laxiformis
McFarlan, n. sp.
Plate 65, figure 14

Frond of the *Fenestella tenax* type, with 22 fenestrules and 24 branches in 1 cm., 23 apertures in 5 mm., and 2 tubercules to the fenestrule.

The only observed specimen shows a portion of one volution similar in character to that of *A. laxus*.

Occurrence.—Okaw limestone from near Ruma, Illinois.

ARCHIMEDES sp.

Frond of the *F. tenax* type borne by the *A. meekanus* axis.

Occurrence.—Clore limestone from near Chester, Illinois, Randolph County.

ARCHIMEDES sp.

A similar frond attached to an axis of the *A. meekanus* var. *distans* type.

Occurrence.—Clore limestone from near Waltersburg, Pope County, Illinois.

ARCHIMEDES sp.

A *F. tenax* frond borne by an axis suggesting *A. invaginatus*.

Occurrence.—Clore limestone, five and three-fourths miles northeast of Vienna, Illinois.

Genus FENESTRELLINA[4] d'Orbigny

Zoarium flabellate or funnel-shaped, celluliferous on the inner side. Branches connected at regular intervals by dissepiments and bearing two rows of zooecial apertures which are separated by a plain or tuberculated median keel (carina).

The reference of the bulk of Fenestellid lid fronds so common in Chester limestones to the genus *Archimedes* has already been made. Of the many forms found in these beds the writer is able to recognize only *F. cestriensis* and *F. exigua* as true *Fenestrellina* with any degree of certainty.

FENESTRELLINA CESTRIENSIS (Ulrich)

Fenestella cestriensis ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 547, pl. 51, figs. 5–5b.

This a very common form in the Renault and Paint Creek formations and has also been observed up through the Glen Dean. The characteristic *Archimedes laxus* of the Glen Dean bears the *F. cestriensis* type of frond, though the fenestration is not quite as coarse. Similar coarsely fenestrated forms having more widely spaced tubercules are classed with *F. exigua*. In the typical form there are 3 to 3½ tubercules to the fenestrule, in *F. exigua* as many as 2 to the fenestrule. Also multituberculed forms with the somewhat finer fenestration of *F. exigua* are here identified as *F. cestriensis*. The typical *F. cestriensis* was described as having 9 to 11 fenestrules in 1 cm.

FENESTRELLINA EXIGUA (Ulrich)

Fenestella exigua ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 545, pl. 51, figs. 1, 1a.

As originally described this species was characterized by a fenestration of about 13 to 14 fenestrules in 1 cm., and a rather meager development of tubercules, usually 1 to 1½ to the fenestrule. As noted above, the writer has included similarly pauci-tuberculated but more coarsely fenestrated forms in this species. Where to place a specific boundary between these and other species is purely arbitrary as the fenestration of both types (based on tuberculation) ranges with complete gradations from coarse ones of the *F. cestriensis* type through *F. elevatipora*, *F. serratula* and the very finely fenestrated *F. tenax*.

F. exigua is commonly associated with *F. cestriensis*.

FENESTRELLINA MULTISPINOSA (Ulrich)

Fenestella multispinosa ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 540, pl. 50, figs. ?–3d.

There is no definite separation of this species from the preceding two as the three intergrade in fenestration and tuberculation. Nor is there any definite separation from *F. serratula*. It was described as having 14 to 15 fenestrules in 1 cm. and two and one-half to three tubercules to the fenestrule.

Attention has already been called to the occurrence of this type of frond in *Archimedes meekanus* and also the Warsaw species *A. wortheni*.

FENESTRELLINA spp.

Other species which commonly have been recognized include: *Fenestrellina serratula*, *F. tenax*, and *F. elevatipora*. The first two types mentioned have already been noted as occurring on a number of axial types of *Archimedes* and also in *Lyroporella*. The last-named is rather suggestive of the *Archimedes swallovanus* frond.

[4] Generally cited in the literature under *Fenestella* Lonsdale. See Condra, G. E., and Elias, M. K., Jour. Paleontology, vol. 15, pp. 565–566, 1941.

Genus POLYPORA McCoy

This genus is abundantly represented in the Chester. On the basis of tuberculation the species are grouped as follows:

1. *Polypora spinulifera* type: Characterized by the development of tubercules in more or less definite rows, alternating with the longitudinal rows of zooecia, and spaced at intervals of approximately that separating the zooecial apertures.

P. spinulifera
P. multispinosa, n. sp.

2. *Polypora approximata* type: Characterized by a single, central row of tubercules.

P. approximata
P. cestriensis
P. tuberculata
P. nodolinearis, n. sp.

3. *Polypora corticosa* type: Characterized by the occasional development and irregular distribution of small tubercules in the interzooecial spaces.

P. corticosa

4. *Polypora complanata*: Of uncertain relationships.

POLYPORA MULTISPINOSA McFarlan, n. sp.
Plate 66, figures 3–7

This species is of the *P. spinulifera* type, differing in the more quadrate and larger fenestrules, the slender dissepiments of the *P. cestriensis* type, stronger branches, and closer spacing of zooecia.

The fenestrules number 4½ to 8½ in 1 cm., with length two to four times width. Apertures 17 to 19 in 5 mm. Dissepiments narrow, width typically one-fourth the length of the fenestrules, expanding but little at either end (*P. cestriensis* type) giving rise to quadrate fenestrules. Reverse much as in *P. approximata*.

There is some variation from the typical and common form. A variety from the Renault (Pl. 66, fig. 6) suggests *P. spinulifera* in the thick dissepiments, expanding at their junction with the branches forming elliptical instead of quadrate fenestrules. The fenestration though is coarser than in that species. Presumably, however, intermediate ones will be found sooner or later. Two specimens have been observed, one in the Glen Dean (Pl. 66, fig. 7) and the other in the Menard, that differ from the typical species in the narrowly rounded branches and stronger spikelike tubercules. Fenestrules 7 to 8½ in 1 cm. Apertures in 3 to 4 or 5 rows, the smaller number for considerable distances above bifurcation, and 18 to 19 in 5 mm.

Occurrence.—A common and characteristic form of the Lower Chester, less conspicuous at higher horizons.

POLYPORA TUBERCULATA Prout
Plate 66, figure 14

Polypora tuberculata PROUT, *1858*, St. Louis Acad. Sci. Trans., vol. 1, p. 449, pl. 18, fig. 3.
Polypora tuberculata, ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 595, pl. 60, fig. 8.

There has been some confusion here due to the discrepancy between Prout's original description and his figure. In the latter he shows from 1½ to 2 tubercules to the fenestrule instead of the 3 or 4 mentioned in his description. The figure also does not show the "slightly raised keel." Quoting Ulrich (1890, p. 596):

> The slightly raised keel which Prout says separates the rows of cells in this species I have never seen, nor are the tuberculations so numerous as stated by him. These characters he probably obtained through confounding a fragment of *P. cestriensis* with the true *P. tuberculata*.[5] His figure is quite reliable, and shows the tubercules as above described, but no lines between the rows of cells. The dissepiments are represented a little too thin.

Specimens in the collections studied tally closely with Prout's figure. Ulrich's figure shows the dissepiments stronger and expanding at their junction with the branches.

POLYPORA NODOLINEARIS McFarlan, n. sp.
Plate 66, figures 8–9

Fenestrules 4 to 6½ in 1 cm., elliptical to subquadrate, length 2½ to 4 times width. Branches frequently irregular in growth, bearing 2 or 3 to 4 or 5 (rarely 6) rows of zooecia. Zooecia usually 21 to 22 (20–24) in 5 mm., arranged between slightly elevated, somewhat granulose, logitudinal

[5] *P. tuberculata* is distinguished from *P. cestriensis* by the narrower subcylindrical branches and closer spacing of the fenestrules.

TABLE 2.—SPECIES OF POLYPORA, CHARACTERS OF OBVERSE SURFACE

Species of *Polypora*	Illustration	Fenestrules		Branches			Dissepiments			Zooecia		
		In 1 cm.	Form	In 1 cm.	Form	Tubercules	Form	Width dissep. / Length fenes.	Width dissep / Width branch	In 5 mm.	No. rows	Peristomes
P. tuberculata Prout	Pl. 66, fig. 14	7–9	Subquadrate $\frac{L}{W}$=2 to 3	12–13	subcylindrical	(a) single central row (b) moderately strong (c) ⅓–½ length of fenestrule	slender, expanding little, rounded, depressed	½ or less	½	17–18	3–5 or 6	prominent
P. cestriensis Ulrich	Pl. 66, fig. 13	5–8	Subquadrate $\frac{L}{W}$=2 to 4	8–10	broadly convex	(a) same (b) rather small (c) ± ½ length of fenestrule	"	½–⅔	½ or less	17–19	3 or 4–5 or 6	very prominent
P. approximata Ulrich	Pl. 66, figs. 11, 12	7–9	Elliptical $\frac{L}{W}$=1½ to 2½	9–10	broadly convex	(a) same (b) strong (c) ⅓–½ length of fenestrule	moderately strong, expanding at ends, broadly rounded, depressed	½–⅓	⅔	17–20	3 or 4 or 6–7	prominent
P. nodolinearis, sp. nov.	Pl. 66, figs. 8, 9	4–6½	Variable $\frac{L}{W}$=2½ to 4		variable	(a) same (b) strong (c) ½–1½ length of fenestrule apart, between longitudinal ridges	variable	½±	variable	21–22	2 or 3–4 or 5	prominent
P. spinulifera Ulrich		10–13	Elliptical $\frac{L}{W}$=1½ to 2½	13	broadly convex	Small, in longitudinal rows alternating with rows of zooecia, interval about the same as spacing of zooecial apertures	strong, expanding at ends, broadly rounded, depressed	½–⅓	⅔	21–23	2 or 3–5 or 6	prominent
P. multispinosa, sp. nov.	Pl. 66, figs. 3–7	4½–8	Typically subquadrate $\frac{L}{W}$=2 to 4		broadly convex	"	slender, typically expanding little	½–⅓	less than ½	17–19	3 or 4–6	prominent
P. multispinosa var. a	Pl. 66, fig. 6	7–7½	Elliptical			"	strong, expanding at ends			17–19		?
P. multispinosa var. b	Pl. 66, fig. 7	7–8½	Subquadrate $\frac{L}{W}$=2 to 3		subcylindrical	"	slender, expanding little	½ or less	½±	18–19	3 or 4–5	prominent
P. complanata Ulrich		7	Subcircular		broadly convex	"	very strong, depressed, flat, expanding at ends	1½–2+	1–2	19–20	3 or 4–9	?
P. corticosa Ulrich	Pl. 66, fig. 10	6–6½	Elliptical $\frac{L}{W}$=1½ to 2½	8–9	broadly convex	Small, developed irregularly from fine wavy lines separating rows of zooecia.	strong, expanding at ends, broadly rounded, depressed	½–1+	less than 1–1½	17–18	3 or 4–6 or 7	small

TABLE 3.—SPECIES OF POLYPORA, CHARACTERS OF REVERSE SURFACE.

Species of *Polypora*	Form of branches	Dissepiments	Fenestrules	Additional features	Characterization	Geological range
P. tuberculata	Narrowly rounded, smooth, or striated	Similar to obverse	Quadrate			Principally Glen Dean and higher formations
P. cestriensis	"	"	"	Slightly elevated, wavy, longitudinal line on obverse in younger part of zoarium	Distinguished from *P. tuberculata* by: 1. Smaller and more closely spaced tubercules 2. Stronger, more broadly rounded branches	Principally Glen Dean and higher formations
P. approximata	Narrower than on obverse, rounded, smooth, or striated	Rounded angular, not depressed	Broad and quadrate		Dis. from *P. tuberculata* and *P. cestriensis* by: Stronger, expanding dissepiments with elliptical fenestrules	Principally Upper Chester
P. nodolinearis	Slightly narrower, striated	About as on obverse, not depressed, striated	About as on obverse	Longitudinal rows of zooecia separated by straight, rounded, granulose ridges. A row of small granules crosses the longitudinal interspaces setting apertures in small quadrate areas.	Tuberculation and longitudinal ridges	Locally common in the Paint Creek, known also in the Golconda
P. spinulifera	Rounded, smooth	Strongly rounded, not depressed, about as strong as the branches	Broadly oval to circular		See *Lyropora spinifera*	Middle and Upper Chester
P. multispinosa	Weaker than on obverse, narrowly rounded, smooth or striated	As in *P. approximata*	Subquadrate	Reverse as in *P. approximata*	Dist. from *P. spinulifera* by: 1. Slender dissepiments and quadrate fenestrules 2. Coarser fenestration 3. Closer spacing of zooecia	Common in the Lower Chester, less so higher in the section
P. multispinosa var. (a)					*P. spinulifera* type of dissepiment and fenestrule	Rare in Renault
P. multispinosa var. (b)					Subcylindrical branches and spine-like tubercules	Rare in Glen Dean and Menard
P. complanata	?	?	?		1. Exceptionally strong branches and dissepiments 2. Small, subcircular fenestrules	Uncertain
P. corticosa	Rounded, almost as strong as obverse	Rounded, not depressed, about as strong as the branches	Broadly rounded	Fine, wavy lines between rows of zooecia	1. Strong dissepiments and branches 2. Tuberculation	Middle and Upper Chester

ridges. A row of small granules may be seen in well preserved specimens, crossing the longitudinal interspaces between the apertures. The apertures with well-developed peristomes are thus set in small quadrate areas, the peristomes rising to an elevation equal to that of the longitudinal ridges. Dissepiments somewhat depressed, usually narrowly rounded, the width equaling less than one-fourth the length of the fenestrules. Strong tubercules occur at irregular and widely spaced intervals along the center of the branch. This interval varies from one-half to one and one-half times the length of the fenestrules.

On the reverse the branches are a little narrower and striated. Dissepiments about as on the obverse, on a level with the branches and frequently longitudinally striated.

The species is characterized by the longitudinal ridges and type of tuberculation.

Occurrence.—Locally common in the Paint Creek limestone of Caldwell County, Kentucky. A single specimen has been found in the Golconda of Randolph County, Illinois.

Genus LYROPORA Hall

Fenestrated expansion as in *Polypora*, spread between the arms of a nonporiferous U- or V-shaped support which is free or pedunculate at the base.

As in *Polypora* the described species may be grouped on the basis of tuberculation, (a) the *P. spinulifera* type of frond, and (b) the *P. approximata* type. The former includes the two new species *L. spinifera* and *L. plana*, the latter *L. subquadrans* and *L. ranosculum*.

This genus together with *Lyroporella* Simpson has its best development in the Lower and Middle Chester. Commonly the fenestrated frond has been pretty well broken away from the support. Little can be done with specimens of the latter other than the recognition of two types; one rounded (e.g., *L. ranosculum*), and the other flattened in cross section (e.g., *L. subquadrans*).

LYROPORA RANOSCULUM Ulrich
Plate 66, figures 15, 16

Lyropora ranosculum ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 581, pl. 58, figs. 1–1c.

A fenestrated expansion of the *P. approximata* type spread between the arms of a strong calcareous support, parabolic in form, and more or less circular in cross section.

Identification of this form, from frond and support characters both, could not be made in the material studied. Ulrich lists it in the Glen Dean from several localities.

LYROPORA SUBQUADRANS (Hall)
Plate 66, figure 20

Fenestella (Lyropora) subquadrans HALL, *1857*, Am. Assoc. Adv. Sci. Proc., vol. 10, p. 180.
Lyropora subquadrans, ULRICH, *1890*, Illinois Geol. Survey vol. 8, p. 582, pl. 58, figs. 2–2e.

A fenestrated expansion similar to the preceding but spread between the arms of a flattened support. Whether the somewhat closer spacing of the tubercules is a consistent feature is not certain.

The species is listed by Ulrich from the Glen Dean at a number of localities.

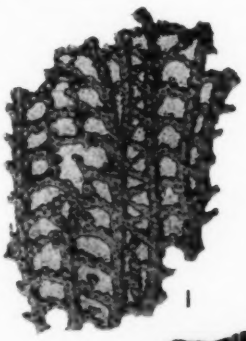
LYROPORA SPINIFERA
McFarlan, n. sp.
Plate 67, figures 5, 6

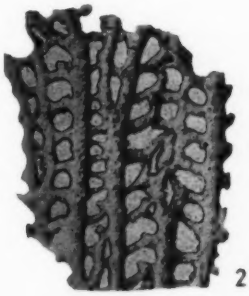
The species consists of a frond of the *Polypora spinulifera* type with a support of the *L. ranosculum* type, i.e., more or less circular in cross section.

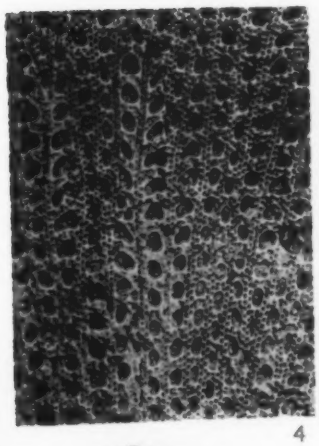
Fenestrules 10 to 13 in 1 cm., elliptical, length 1½ to 2 times width. Branches strong, broadly convex, 12 to 16 in 1 cm., and bearing 3 to 6 rows of zooecia. Dissepiments strong, slightly depressed, expanding at their junction with the branches, in width about equal to the length of the fenestrules and equal to or slightly exceeding the width of the branches just above bifurcation. Apertures 20 to 21 in 5 mm. Peristomes but slightly elevated. Alternating with the rows of apertures are rows of small tubercules spaced at intervals about equal to those separating the apertures.

On the reverse the branches and dissepiments are much more narrowly rounded, about equal in strength, and on the same level. Both are smooth. The fenestrules are comparatively broader, and polygonal to subquadrate.

From *P. spinulifera*, the frond of this form is distinguished by the stronger dissepiments. *P. multispinosa* is much more coarsely fenestrated, has slender dissepi-


1

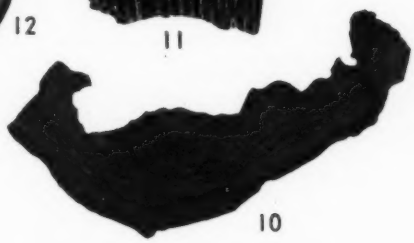

2

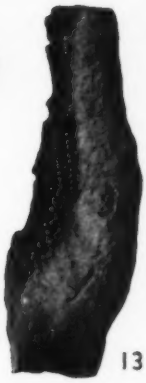

4

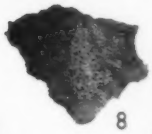
12

11

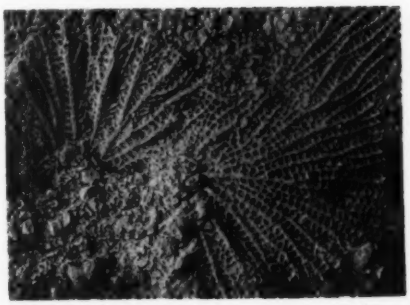
9


10

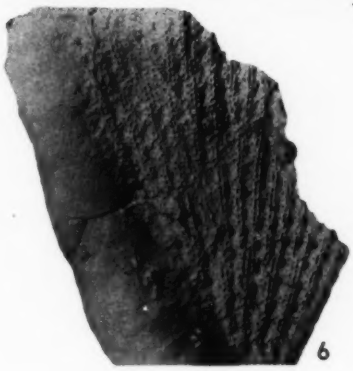

13


8

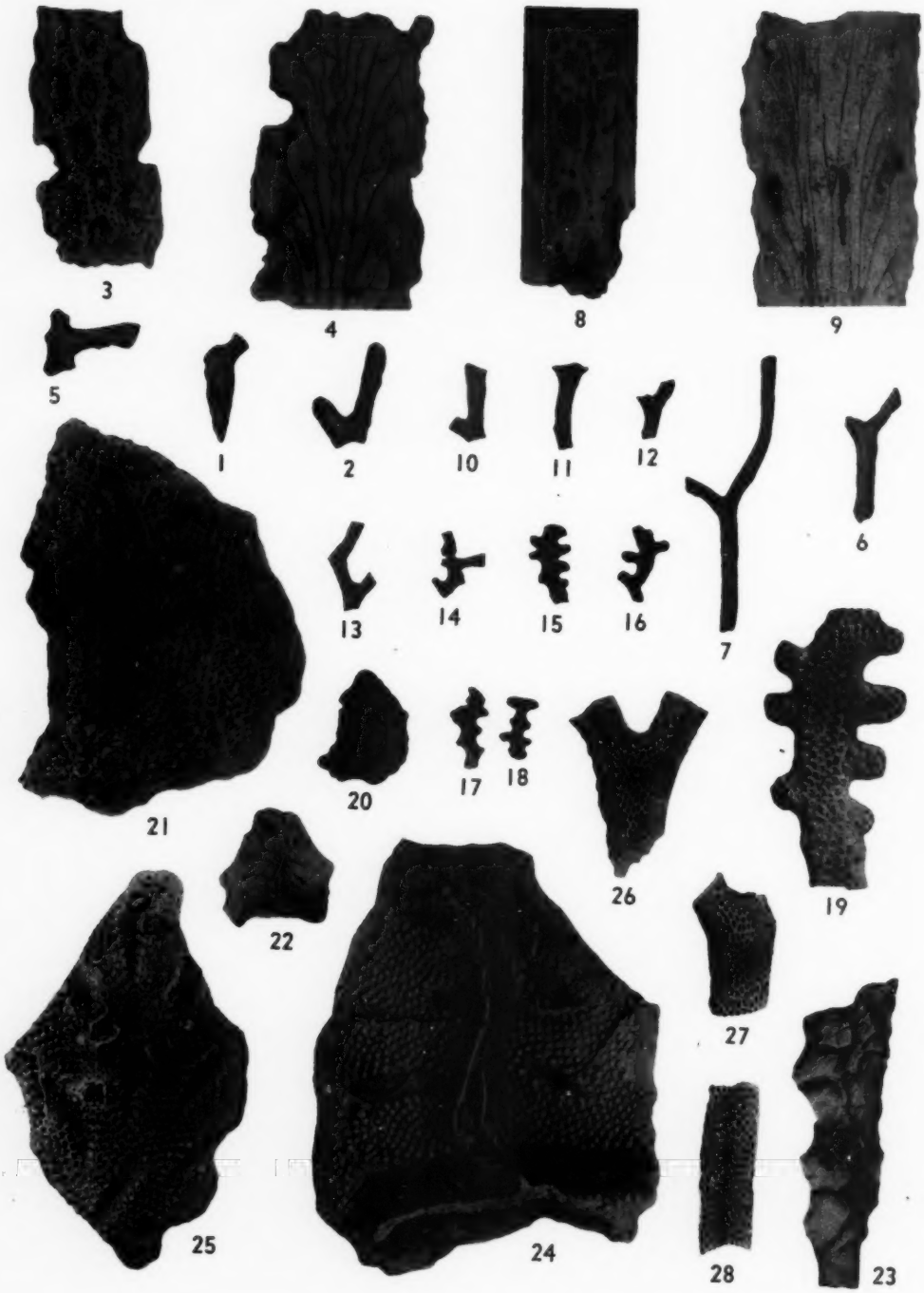
7


3

5


6

McFarlan, Chester Bryozoa



McFarlan, Chester Bryozoa

ments and normally subquadrate fenestrules.

Occurrence.—The few specimens known have come from the Renault and Paint Creek formations.

LYROPORA PLANA
McFarlan, n. sp.
Plate 66, figure 19

A fenestrated expansion as above with the flattened support of the *L. subquadrans* type.

Occurrence.—Two specimens are known, one from the Paint Creek and the other from the Golconda.

Genus LYROPORELLA Simpson

Zoarium as in *Lyropora* but branches more or less carinated and bearing but two rows of zooecia except just before bifurcation where commonly for a considerable distance the branch is double. The frond is essentially that of a *Fenestrellina*.

The name was first used in the Thirteenth Annual Report of the State Geologist of New York, 1893, and in the annual report for the following year. *L. quincuncialis* was mentioned as the genotype.

Nickles and Bassler (1900) discarded the term as well as *Lyroporina* and *Lyroporidra*. The writer finds a well defined group of species characterized by the above mentioned features.

LYROPORELLA QUINCUNCIALIS (Hall)
Plate 67, figures 7–9

Fenestella (*Lyropora*) *quincuncialis* HALL, *1857*, Am. Assoc. Adv. Sci. Proc., vol. 10, p. 180.

Lyropora quincuncialis, ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 583, pl. 58, figs. 3–3d, pl. 55, figs. 7–7c.

Lyroporella quincuncialis, SIMPSON, *1897*, Fourteenth Ann. Rep. State Geologist, New York, for the year 1894, p. 516, fig. 69.

Fenestrules 14 to 22 in 1 cm., elliptical, length 1½ to 2½ times width. Branches strong, broadly angular, with a faint carina, and bearing two rows of zooecia except just before bifurcation where for the length of a number of fenestrules three ranges are present. Here the branches, when worn, appear rounded, but fresh material shows three faces separated by faint, tubercule-bearing carinae. This "double branch" is best shown in the more coarsely fenestrated specimens. Dissepiments depressed, strong, width equal to the length of the fenestrules, and to the width of the branches after bifurcation, expanding at their junction with the branches and each bearing centrally a prominent tubercule. Apertures 26 to 27 in 5 mm. A row of tubercules is developed along the center of the branch, spaced at intervals of 2 to 2½ to the fenestrule.

On the reverse the branches and dissepiments are of about equal strength, with the latter frequently the stronger, which, together with the comparatively broader and more quadrate fenestrules, obscures the dif-

---

EXPLANATION OF PLATE 67

FIGS. *1–3*—*Septopora subquadrans* Ulrich. *1, 2*, Obverse and reverse, ×3½, W. M. 28254, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky; *3*, zoarium, natural size, showing the peculiar manner of branching, W. M. 28162, Golconda limestone (lower Okaw), east bluff of Cypress Creek along the Dongola-Vienna Road, Union County, Illinois. (p. 454)

4—*Septopora cestriensis* Prout. Portion of frond, ×3½, W. M. 28220, Menard limestone, Walche's Cut on the Louisville and Memphis branch of the Illinois Central Railroad (Claxton Station vicinity), five miles southeast of Princeton, Caldwell County, Kentucky. (p. 454)

5, 6—*Lyropora spinifera*, McFarlan, n. sp. *5*, Reverse of holotype, ×1, W. M. 28179, Paint Creek limestone, three and one-half miles northeast of Prairie du Rocher, Randolph County, Illinois; *6*, obverse of another specimen, ×3½, Paint Creek limestone, Walche's Cut on the Louisville and Memphis division of the Illinois Central Railroad (Claxton Station vicinity), five miles southeast of Princeton, Caldwell County, Kentucky. (p. 447)

7–9—*Lyroporella quincuncialis* (Hall). *7, 8*, Collection of the United States National Museum, Chester Group, Chester, Illinois; *9*, fragment of frond, ×3½, W. M. 28186, Clore limestone, Macs Creek Hill, five and three-fourths miles northeast of Vienna, Johnson County, Illinois. (p. 448)

10, 11—*Lyroporella carinata*, McFarlan, n. sp. Holotype, natural size and ×3½, W. M. 21821, Renault limestone, four miles east of Waterloo, Monroe County, Illinois. (p. 449)

12, 13—*Lyroporella lyroides*, McFarlan, n. sp. Type, ×1 and ×3½, W. M. 28201, Golconda limestone, three-fourths mile southeast of Scottsburg, Caldwell County, Kentucky. (p. 453)

ferentiation of branches and dissepiments.

The base is similar to that of *L. ranosculum*, strong, and subcircular in cross section.

Occurrence.—Finely fenestruled forms with 20 to 22 fenestrules in 1 cm. are fairly common in the Renault and Paint Creek, and are present also in the Golconda. The stratigraphic position of Hall's type is not known. Ulrich's specimens (hypotypes) with 16 to 18 fenestrules in that distance are from the Glen Dean from Sloan's Valley, Kentucky. A specimen of the frond from the Clore limestone from Johnson County, Illinois, has 14 fenestrules in 1 cm. The increasing coarseness in fenestration at higher horizons suggested in these specimens is also indicated in *L. divergens*.

LYROPORELLA DIVERGENS (Ulrich)
Plate 66, figures 17, 18

Lyropora divergens ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 584, pl. 58, figs. 4–4b, 4d.

Frond characters essentially as in *L. quincuncialis*. Minor differences, which are probably not significant, are the somewhat wider spacing of the apertures (23 to 24 in 5 mm., occasionally as high as 25 in the more finely fenestrated forms), and the somewhat weaker dissepiments.

The base is a thick flattened expansion comparable to that of *L. subquadrans*.

As far as frond is concerned this species is characterized, as is also *L. quincuncialis*, by the tubercule developed on each dissepiment. The "double branch" with its three rows of zooecia has been observed extending a distance of as much as six fenestrules below complete bifurcation and four rows have been observed just below bifurcation.

Occurrence.—Four specimens of known stratigraphic position have been found; one from the Renault, two from the Golconda, and one from the Menard. Of these the Renault form was the most finely fenestruled and the Menard specimen the most coarsely. Ulrich's cotypes are listed from Chester, Illinois, and from the Glen Dean from Sloan's Valley, Kentucky.

LYROPORELLA CARINATA
McFarlan, n. sp.
Plate 67, figures 10, 11

Fenestrules 19 to 26 in 1 cm., elliptical, length one and one-half to three times width. Branches 23 to 28 in 1 cm., typically fenestellid, narrowly angular and with well developed carina. The point of bifurcation is marked by the intercalation of a third row of zooecia which may persist for a dis-

---

EXPLANATION OF PLATE 68

FIGS. *1–4—Rhombopora millepuncta*, McFarlan, n. sp. *1*, Holotype, ×3½, W. M. 28110; *2*, paratype, ×3½, W. M. 28111; *3, 4*, tangential and longitudinal section, ×30, Clore limestone, two miles northeast of Waltersburg, Pope County, Illinois. (p. 454)

5—Rhombopora millepuncta var. *recta*, McFarlan, n. var. Holotype, ×3½, W. M. 28112, Clore limestone, two miles northeast of Waltersburg, Pope County, Illinois. (p. 455)

6–9—Rhombopora cf. *pulchella* Ulrich. *6, 7*, ×3½, W. M. 28113; *8, 9*, tangential and longitudinal sections, ×30, Clore limestone, two miles northeast of Waltersburg, Pope County, Illinois. The specimens have the general appearance of *R. pulchella* differing in the narrower apertures and surrounding areas which tend to coalesce longitudinally giving more of a longitudinal rather than diagonal arrangement. The specimens, however, are probably immature individuals of that species.

10–13—Sulcoretepora labiosa (Weller), W. M. 28244, natural size, Paint Creek formation, seven miles southeast of Princeton, Caldwell County, Kentucky. *Note:* This name as well as the varietal name "*aligera*" appear in the writings of E. O. Ulrich but without figures or description. The species was described and figured by Weller, Illinois Geological Survey, Bull. 41, 1920, who, however, did not differentiate the variety. (p. 455)

14–19—Sulcoretepora labiosa var. *aligera*, McFarlan, n. var. *14–18*, Syntypes, natural size, W. M. 28245; *19*, same as *15*, ×3½, Paint Creek formation, seven miles southeast of Princeton, Caldwell County, Kentucky. (p. 455)

20–21—Glyptopora punctipora Ulrich. Fragment of zoarium, natural size and ×3½, W. M. 28118, Renault limestone, three miles east of Waterloo, Illinois.

22–25—Glyptopora pustulifera, McFarlan, n. sp. *22*, Holotype, natural size; *23*, specimen incrusting a crinoid stem, natural size, W. M. 28264, Renault limestone, four and one-half miles southwest of Red Bud, Illinois; *24*, holotype, ×3½; *25*, ×3½, Paint Creek limestone, seven miles southeast of Princeton, Caldwell County, Kentucky. (p. 455)

26–28—Rhombopora tabulata Ulrich. Three fragments, ×3½, W. M. 28202, Golconda limestone, three-fourths of a mile southeast of Scottsburg, Caldwell County, Kentucky.

TABLE 4.—CHARACTERS OF SPECIES OF LYROPORA.

OBVERSE SURFACE

Species of *Lyropora*	Illustration	Fenestrules		Branches			Dissepiments			Zoecia		
		In 1 cm.	Form	In 1 cm.	Form	Tubercules	Form	Width dissep. Length fenes.	Width dissep. Width branch	In 5 mm.	No. rows	Peristomes
L. subquadrans Hall	Pl. 66, fig. 20	10–13	Elliptical $\frac{L}{W}=1\frac{1}{2}$ to 2	12–14	Strong, broadly convex	*Polypora approximata* type, strong, forming central row, ½–¾ length of fenestrule apart	Strong, depressed, expanding at the ends	1	1	20–22	4–6	Distinct
L. ranoscuium Ulrich	Pls. 66, figs. 15–16	9–11	"	15±	"	*Polypora approximata* type, strong, forming central row, ½–¾ length of fenstrule apart	"	1	1	20–22	3–5	Distinct
L. spinifera, sp. nov.	Pl. 67, figs. 5, 6	10–13	"	12–16	"	*Polypora spinulifera* type, small; in rows alternating with horizontal rows of zooecia, spacing same as apertures	"	1	1	20–21	3–6	Distinct
L. plana, sp. nov.	Pl. 66, figs. 19	10–13	"	12–16	"	"	"	1	1	20–21	3–6	Distinct

REVERSE SURFACE

Species of *Lyropora*	Form of branches	Dissepiments	Fenestrules	Additional features	Characterization	Geological occurrence
L. subquadrans Hall	More narrowly rounded than reverse	More narrowly rounded and not depressed	Larger, oval to subquadrate	Base flattened, fan shaped, a lateral tubercule opposite many dissepiments	Distinguished from *L. ranosculum* by: 1. Nature of basal support 2. Closer spacing of tubercules (?)	Glen Dean
L. ranosculum Ulrich	"	"	"	Base strong, parabolic, circular in section		Glen Dean
L. spinifera, sp. nov.	Much more narrowly rounded than reverse	"	"	"	Dist. from *Polypora spinulifera* by: 1. Generic characters 2. Thicker dissepiments and hence smaller fenestrules	Renault-Paint Creek
L. plana, sp. nov.	"	"	"	Base as in *L. subquadrans*	Dist. from *L. spinifera* by: Nature of basal support	Paint Creek and Golconda

TABLE 5.—CHARACTERS OF SPECIES OF LYROPORELLA

OBVERSE SURFACE

Species of *Lyroporella*	Illustration	Fenestrules		Branches			Dissepiments			Zooecia		
		In 1 cm.	Form	In 1 cm.	Form	Tubercules	Character	Width dissep. Length fenes.	Width dissep. Width branch	In 5 mm.	Rows	Peristomes
L. carinata, sp. nov.	Pl. 67, figs. 10, 11	19–26	Elliptical, $\frac{L}{W}$ = 1½ to 3	23–28	Narrow, carinated	Small, spaced ⅓–⅔ length of fenestrule	Moderately strong, depressed, slightly carinated	½	½	26–27	2, 3 for a very short distance below bifurcation	Small
L. quincuncialis (Hall)	Pl. 67, fig. 7–9	14–22	Elliptical, $\frac{L}{W}$ = 1½ to 2½	24–26	Broadly angular, carina poorly developed	Strong, spaced ⅓–⅔ length of fenestrule	Strong, depressed broadly rounded, with central tubercule	1–1+	1	26–27	2, 3 for variable distance below bifurcation	Small
L. divergens (Ulrich)	Pl. 66, figs. 17, 18	14–21	Elliptical, $\frac{L}{W}$ = 2 to 3		"	"	Moderately strong, depressed, rounded, with central tubercule	½	½	23–24	2, rarely 4	Small
L. lyroides, sp. nov.	Pl. 67, figs. 12, 13	18	Elliptical, $\frac{L}{W}$ = 1 to 2		Narrow, carinated	Small, spaced ⅓–½ length of fenestrule	Strong, depressed, rounded, with central tubercule	1–1+	1±	23–24	2	Small
L. ? *ovalis* Ulrich		10		16						20	2, 3 for a short distance below bifurcation	Small

REVERSE SURFACE

Species of *Lyroporella*	Form of branches	Dissepiments	Fenestrules	Other characters	Characterization	Geologic occurrence
L. carinata, sp. nov.	Narrowly rounded	Narrowly rounded, on level with, and almost as strong as branches	Variable	Base flattened, fan-shaped, pedunculate	Dissepiments not tuberculate	Renault, Paint Creek
L. quincuncialis (Hall)	Rather strong, rounded	Rounded, on level with, and locally stronger than branches	Variable, broader than obverse	Base strong, parabolic, subcircular in section		Throughout Chester
L. divergens (Ulrich)	Rounded	Narrowly rounded, and level with branches	"	Base flattened, fan-shaped, pedunculate	Distinguished from *L. quincuncialis* by: 1. Nature of base 2. Wider spacing of apertures 3. Weaker dissepiments	Throughout Chester
L. lyroides, sp. nov.	Rounded	Rounded, on level with branches		Base more or less lyre-shaped, elliptical in section	Small, closely spaced tubercules. Distinguished from *Archimedes invaginatus* by: 1. Stronger dissepiments 2. Generic characters	Golconda (very rare)
L. ? *ovalis* Ulrich			Suboval-circular			

TABLE 6.—REPETITION OF FROND TYPES AMONG ZOARIAL TYPES OF FENESTRELLINIDAE

Zoarial type \ Frond type	*"Fenestrellina tenas, F. serratula,"* etc.	*Archimedes invaginatus*	*Polypora spinulifera*	*Polypora approximata*	*Polypora corticosa*
Archimedes	*A. meekanus* and varieties *A. bassleri*	*A. invaginatus* and varieties *A. symmetricus* *A. parlaxus* *A. tortuosus*			
Lyroporella	*L. carinata*	*L. quincuncialis* *L. divergens* *L. lyroides*			
Lyropora			*L. spinifera* *L. plana*	*L. ranosculum* *L. subquadrans*	
Polypora			*P. multispinosa* *P. spinulifera* *P. complanata*	*P. approximata* *P. cestriensis* *P. tuberculata* *P. nodolinearis*	*P. corticosa*
Thamniscus			*T. furcillatus*	*T. ramulosus*	

tance of a couple of fenestrules. Bifurcation, however, is usually completed within the length of a single fenestrule. Dissepiments depressed, slightly carinated, width about equal to two-thirds the length of the fenestrules and to the width of the branches just above bifurcation. Apertures with small projecting peristomes 26 to 27 in 5 mm. Distinct tubercules are borne by the carina spaced at intervals of from two-thirds to the length of a fenestrule apart.

On the reverse the branches and dissepiments are narrowly rounded, the dissepiments almost if not quite as strong as the branches, and not depressed. Fenestrules variable.

The support is a flattened expansion, in the type more or less fan-shaped and drawn out at the point of attachment.

The species is separated from other *Lyroporellas* by the nature of the support and absence of tubercules on the dissepiments.

Occurrence.—A number of specimens are known from the Renault and Paint Creek.

LYROPORELLA LYROIDES
McFarlan, n. sp.
Plate 67, figures 12, 13

This species is represented by a single individual closely related to *L. divergens* and *L. quincuncialis*. Fenestrules 18 in 1 cm., elliptical, length 1 to 2 times width. Branches carinated, bearing usually 3 but sometimes only 2 tubercules to the fenestrule. Apertures 23 to 24 in 5 mm. with distinct peristomes. Dissepiments depressed, strong, width equal to or slightly exceeding the length of the fenestrules and about equal in strength to the branches just above bifurcation. Each dissepiment is marked by a prominent, central tubercule.

The basal support is not complete but appears to be more or less lyre-shaped, and elliptical in cross section.

The frond while differing from *L. divergens* and *L. quincuncialis* in the more numerous and smaller tubercules, has the strong dissepiments of the latter and closer spacing of the apertures of the former. The tuberculation and branches are suggestive of *Archimedes invaginatus* but the dissepiments are much stronger.

Occurrence.—The type and only specimen is from the Golconda limestone from near Scottsburg, Kentucky.

LYROPORELLA? OVALIS (Ulrich)

Lyropora ovalis ULRICH, *1890*, Illinois Geol. Survey, vol. 8, p. 585, pl. 58, figs. 5–5b; pl. 55, fig. 8.

This species was based on a single speci-

men from the Glen Dean from Grayson Springs, Kentucky, showing only the reverse surface and without any of the basal portion of the support. It is a coarsely fenestrated form, apparently belonging to *Lyroporella*. The writer has no specimens.

Genus SEPTOPORA Prout

Ulrich has divided the known species into two groups characterized by:

(1) Addition of new branches by interpolation (more typical of the Pennsylvanian than Chester).

(2) Addition of new branches chiefly by dichotomy (not known above the Chester).

Septopora is unknown below the Chester except for a single species. *S. similis* was described by Stuart Weller (1920) from the St. Louis limestone near Little Rock, Missouri.

A synopsis of the Chester species of Septopora.—Group 1: New branches added by interpolation only.

S. biserialis var. *nervata* Ulrich is a form with both primary and secondary branches, the latter given off from the former in a somewhat pinnate manner. Upon attaining greater strength these take on the character of primary branches. Fenestrules 8 or 9 in 1 cm. Listed from the Glen Dean.

In *S. robusta* var. *intermedia* Ulrich the new branches are either given off from the sides of the older branches or originate on a dissepiment. Fenestrules 7 to 9 in 1 cm. Listed from the Glen Dean and Clore.

Group 2: New branches formed chiefly by dichotomy.

S. cestriensis Prout is characterized by the small, rounded fenestrules and the short dissepiments which expand markedly at their junction angles. Fenestrules 9 to 13 in 1 cm. Present throughout the Chester.

S. subquadrans Ulrich differs from the preceding species in the longer and more arched dissepiments, with the resulting transversely elongate crescentic or subquadrate fenestrules. The dissepiments are occupied by more numerous zooecia which are arranged in two rows, while in *S. cestriensis* there is a tendency to form three. The characters in this species as well as in *S. cestriensis* are quite variable and some specimens may well be identified as either. Fenestrules 8½ or 9 to 13 in 1 cm. Common throughout the Chester.

S. rectistyla (Whitfield) is a form suggesting *S. cestriensis* but with a single row of zooecia on the dissepiments. Fenestrules 10 to 11 in 1 cm. Geologic occurrence within the Chester not known.

S. decipiens Ulrich is a slender, pinnate stipe with short, usually tapering pinnae numbering 12 to 13 in 1 cm. on each side. A fenestration is often formed just above bifurcation. Listed from the Paint Creek and Glen Dean.

Genus RHOMBOPORA Meek

Girty (1915) found some difficulty in distinguishing *Rhombopora* from the trepostome *Batostomella*. A structure simulating the vestibulum is occasionally developed in *Batostomella*, and he notes that the equally characteristic hemisepta are more commonly absent than present in *Rhombopora*. He also called attention to a group of English *Tabuliporas* in which the diaphragms have marginal rather than central perforations. Such perforated diaphragms are essentially like hemisepta. Absence of mesopores Girty correlated with regularity in arrangement of the tubes. Maculae and monticules were regarded as characteristic of *Batostomella*.

Forms studied in this paper, with the exception of *R. minor*, show typical hemisepta and vestibula. Ulrich's figures show occasional hemisepta in that species.

RHOMBOPORA MILLEPUNCTA
McFarlan, n. sp.
Plate 68, figures 1–4

Zoarium slender, dendroid, about ½ mm. in diameter. Apertures oval to circular, set in well defined areas and arranged in rather irregular diagonally intersecting series. Interspaces equal to or slightly greater than diameter of apertures. The characteristic feature of the species is found in tangential section where the zooecial walls are dotted by numerous minute acanthopores. Longitudinal sections are distinguished from those of *R. pulchella* by these same acanthopores, and the presence of a prominent inferior hemiseptum projecting half way across the zooecial cavity, occupying a position considerably below the primary orifice.

Species	Renault																Paint Creek																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	A_1	A_2	A_3	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	32	33	34	35	36	D	G	H
Archimedes invaginatus		x																		x					x		x	x	x	x	x					x	x		x	x
var. *meekanoides*	x																										x		x	x	x					x				
var. *remotus*																													x	x	x									
tortuosus																													x	x										
parlaxus																												x		x	x									
symmetricus																																						x			
swallovanus																																						x		x	
var. *lativolvis*																												t												
var. *intermedius*																								t			t	t												
var. *communis*																				t			t	t			t			t	t							?		
var. *compactus*																											x										?			
confertus																cf												x						x			x	x	x	x
meekanus																												x				x				t		x	x	
var. *distans*																												x												
var. *proutanus*																												x												
var. *conicus*																												x												
bassleri																																					x	?	x	x
laxiformis																																						x	x	x
laxus																																								x
sublaxus																																								
perminimus																																								
terebriformis																																						x		
Fenestella cestriensis			very common												x	x	x					very common																	
exigua			common																			common																	
Reteporina flexuosa																x																								
Lyropora ranosculum																	cf																							
subquadrans					x			x											x				x	x		x				x	x									
spinifera																							x																	
plana																																					x			
Lyroporella quincunxialis										x	x	x		x			cf																							
divergens									x										x					x		x														
lyroides			x																																					
carinata																																								
Polypora approximata															cf	cf																								
cestriensis																																								
tuberculata																														x	x									
nodolinearis																cf	cf																							
corticosa																																								
spinulifera																				x	x					x			x	x	x	x		x						
multispinosa	x	x	x					x	x													x																		
complanata																									x		x					x					x		x	
Thamniscus furcillatus																																								
ramulosus																																								
Diploporaria bifurcata																																								
Septopora cestriensis	x															x									x											x		x	
biserialis var. *nervata*																																							x	
decipiens																																								
pinnatiformis																																								
robusta var. *intermedia*																?														x	x	x			x					
subquadrans			x																																				x	
Coeloconus grannosus																x					x								x		x	x	x							
rhombicus																					x									x		x								
Rhombopora armata																x																							x	x
persimilis		x																														x							x	
pulchella		x												x																										
tabulata		?																																						
millepuncta																																								
var. *recta*																																x							x	
minor																																								
tenuirama																																								
Streblotrypa distincta																x					x				x		x					x	x					x	x
nicklesi		x																																						
subspinosa																									x															
Heliotrypa bifolia																					x	x			x				x	x	x	x	x		x		x	x		
Cystodictya labiosa									x					x							x								x	x	x	x	x				x			
var. *aligera*								x													x								x	x	x	x	x							
Glyptopora punctipora		x	x					x								x	x	x							x				x				x						
pustulifera			x					x																																x
Prismopora serrulata														•																										
Cyclopora fungia																																								
Sphragiopora parasitica																x	x																							

† Numerals = authors collections; letters = from published lists; t = axis only; boldface type = abundant.

PAINT CREEK

20	21	22	23	24	25	26	27	28	29	30	32	33	34	35	36	D	G	H	i	j	37	38	40	41	44	45	46	47	50
			x		x x	x	x x x	x x x x x x	x x x x x	x				x x x			x	x	?		x		x x t t t x x	x	t t t t t		t t		
	t	t t			t x	x t t x x x x x	x	t	t t	x			x		t	? x	x ? x	x x	x x x									
																x	? x	x x x											
very common common																	x												
																													x
	x x	x		x				x	x															x				
		x		x												x			x			x						x x
			x			x	x x	x x	x	x		x			x		x x x	x			x	x x x	x x		x	x	x x	
		x		x						x					x		x									x	x		
		x					x	x	x			x		x			x		x		x x	x						
						x	x	x	x	x x							x												x
		x		x					x	x						x	x								x	x		x
		x				x x	x x	x x	x x	x x		x		x x	x					x									
		x				x		x			x						x	x		cf									
																	x												

Golconda															Glen Dean																				Vienna	Menard								Clore						Kinkaid	Buffalo Wallow
45	46	47	50	51	52	53	54	56	M	N	O	P	Q	57	58	60	61	62	63	64	R	S	T	U	V	W	65	69	70	71	72	73	74	75	BB	76	77	78	79	DD	EE	80	GG
t	t t		t x x t t t t t	t t t	t t t t t		t	x t	x x x x ?	x	x x x cf. x ?	x		t t t t t		t t x	t x		t t t t x	x x t	x x x x x	cf x x x x x	x x x x x x	cf x x x x x	x x x x x x	cf x x x x x	t	x	x t x x t	x x x x x x	x	x			x t t	x x x x x x		x x x x x x	x	x x x	x x x	x		x x x x x	x x x
x	x x	x x	x	x	x	x	x	x	x	x	x	x x		x x x x	x	x x	x x x	x	x	x	x	x	x ?	x x x x x x	x x x x x x	x x x x x x	x x	x x x x x x	x x x x x x	x x x x

Occurrence.—Rather common in the Clore limestone from near Waltersburg, Pope County, Illinois. Superficially it resembles the abundant *R. nitidula* of that horizon, except where the state of preservation leaves evident the relatively strong acanthopores of that species.

RHOMBOPORA MILLEPUNCTA var. RECTA
McFarlan, n. var.
Plate 68, figure 5

The relationship is similar to that existing between *R. pulchella* and *R. persimilis*. The branches are given off at right angles.

Occurrence.—Associated with *R. millepuncta*.

Genus SULCORETEPORA[6] d'Orbigny
SULCORETEPORA LABIOSA (Weller)
Plate 68, figures 10–13

Cystodictya labiosa WELLER, *1920*, Illinois Geol. Survey Bull. 41, p. 350, pl. 7, figs. 10–18, 20–24.

Zoarium bifoliate, of ramose, flattened, ribbon-like branches 2½ to 3 mm. in width, with well-defined, non-poriferous margins. These bifurcate at intervals varying from 2 to 10 mm. Zooecia in diagonally intersecting series, with interspaces somewhat wider than the diameter of the apertures. A less conspicuous linear arrangement is also present. Apertures pustulose, particularly marginally. Peristomes well devloped, more elevated distally, flattening that side of the otherwise elliptical or subcircular apertures. Opposite this side the apertures are slightly indented. The longer and transverse diameter is commonly about 0.02 mm.

This species is distinguished from *C. pustulosa* by the more crowded and less distinct linear arrangement of the apertures, and the distal instead of lateral elevation of the peristomes.

Occurrence.—An extremely common and characteristic fossil of the Renault and Paint Creek formations in western Kentucky.

SULCORETEPORA LABIOSA var. ALIGERA
McFarlan, n. var.
Plate 68, figures 14–19

Cystodictya labiosa WELLER, *1920*, Illinois Geol. Survey Bull. 41, pl. 7, figs. 7–9, 19.

The varietal designation is applied to those forms in which the lateral margins are modified by the presence of numerous, small lateral branchlets, which are commonly no more than small, rounded projections.

The names *Cystodictya labiosa* and the variety *aligera* were both used by Ulrich but were neither described nor figured.

Occurrence.—Associated with and equally as common as *C. labiosa*.

Genus GLYPTOPORA Ulrich
GLYPTOPORA PUSTULIFERA
McFarlan, n. sp.
Plate 68, figures 22–25

This species is distinguished from *G. punctipora* Ulrich by the deep set, conspicuous maculae and border strips. In the specimens examined the maculae are a little larger, averaging about 3 mm. in length, and the apertures a little more closely spaced, with about 14 in 5 mm.

From other species it is distinguished by the small, pustuliform apertures.

Occurrence.—Rather common in, and characteristic of, the Renault and Paint Creek formations.

LIST OF LOCALITIES REFERRED TO IN FAUNAL CHART[7]
RENAULT FORMATION

1. Two miles east of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
2. Three miles east of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
3. Four miles east of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
4. Bixby, Waterloo Quadrangle, St. Claire County, Illinois
5. Two and one-half miles south of Columbia, Waterloo Quadrangle, Monroe County, Illinois.
6. Four and one-half miles northeast of Waterloo, Waterloo Quadrangle, St. Claire County, Illinois.
7. Four and one-half miles southwest of Red Bud, Renault Quadrangle, Monroe County, Illinois.
8. Four miles west of Red Bud, Renault Quadrangle, Monroe County, Illinois.
9. Shetlerville, northeast corner of Golconda Quadrangle, Hardin County, Illinois.
10. One-half mile east of Eichorn, Golconda Quadrangle, Hardin County, Illinois.
11. One mile east of Eichorn, Golconda Quadrangle, Hardin County, Illinois.
12. Cedar Bluff (Cedar Hill), 2½ miles southeast of Princeton, Caldwell County, Kentucky.

[6] Generally cited in the literature under *Cystodictya* Ulrich.

[7] Numerals refer to collections studied by the author; letters to faunal lists of others.

13. Six miles southeast of Princeton, Caldwell County, Kentucky.
14. Waterloo Quadrangle, Illinois. Locality not known.

UPPER OHARA=RENAULT

A_1, A_2, A_3. (E. O. Ulrich, 1917, p. 140) Caldwell and Christian counties, Kentucky.

B. (Charles Butts, 1922, p. 153) Between Elihu and Cedar Grove on Cincinnati Southern Railroad south of Somerset, Kentucky.

C. (Stuart Weller, 1927, p. 29) Shetlerville member of Renault, Crittenden County, Kentucky.

PAINT CREEK FORMATION

15. Four miles east of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
16. Six and three-fourths miles southeast of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
17. Seven miles southeast of Waterloo, Waterloo Quadrangle, Monroe County, Illinois.
18. Two miles south of Columbia, Waterloo Quadrangle, Monroe County, Illinois.
19. Columbia, Waterloo Quadrangle, Monroe County, Illinois.
20. Three miles east of New Design, Waterloo Quadrangle, Monroe County, Illinois.
21. One and one-fourth miles northwest of Floraville, Waterloo Quadrangle, St. Clair County, Illinois.
22. Three miles east of Prairie du Rocher, Renault Quadrangle, Randolph County, Illinois.
23. One and three-fourths miles northwest of Ruma, Renault Quadrangle, Randolph County, Illinois.
24. Three and one-half miles northeast of Prairie du Rocher, Renault Quadrangle, Randolph County, Illinois.
25. Six miles south of Vienna, Vienna Quadrangle, Massac County, Illinois.
26. Four miles southeast of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
27. Seven miles east-southeast of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
28. Opposite side of valley from no. 27.
29. Walche's Cut on the Louisville and Memphis branch of the Illinois Central Railroad, five miles east of Princeton, Princeton, Quadrangle, Caldwell County, Kentucky.
30. Scottsburg, Princeton Quadrangle, Caldwell County, Kentucky.
31. Six and three-fourths miles southeast of Scottsburg, Princeton Quadrangle, Caldwell County, Kentucky.
32. Two and one-fourth miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
33. One-fourth miles south of Locality no. 27.
34. Three miles northeast of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
35. Three miles southeast of Princeton, just north of the Evansville and Hopkinsville branch of the Illinois Central Railroad, Caldwell County, Kentucky.
36. Five miles southeast of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.

GASPER=PAINT CREEK

D. (Charles Butts, 1917, p. 77) Chiefly from non-oolitic beds, and mainly from Breckinridge County, Kentucky.

E. (Charles Butts, 1917, p. 81) From an oolitic bed near the top of the formation, in the western edge of Christian County, Kentucky.

F, G, H. (E. O. Ulrich, 1917, p. 147) Caldwell and Christian counties, Kentucky.

I. (Charles Butts, p. 75) Ridenhower shale, Ridenhower, Illinois.

J. (Charles Butts, p. 76) Along the Ohio River, one-half mile south of Golconda, Pope County, Illinois.

K. (Charles Butts, 1922, pp. 160, 161) General list for eastern and central Kentucky.

L. (Stuart Weller, 1927, p. 36) Paint Creek, Preacher Creek, Cave-In-Rock Quadrangle, Kentucky-Illinois.

GOLCONDA FORMATION

37. Lower Okaw, one mile north of Ruma, Renault Quadrangle, Randolph County, Illinois.
38. Lower Okaw, south branch of Campbell Creek, two and three-fourths miles southwest of Ruma, Renault Quadrangle, Randolph County, Illinois.
39. Okaw, one and one-half miles south of Marigold, Renault Quadrangle, Randolph County, Illinois.
40. One mile northwest of Marigold, Renault Quadrangle, Randolph County, Illinois.
41. Lower Okaw, Fort Gage, Chester Quadrangle, Randolph County, Illinois.
42. Okaw, near Fort Gage, Chester Quadrangle, Randolph County, Illinois.
43. Two miles north of Reevesville, Vienna Quadrangle, Johnson County, Illinois.
44. Southeast slope of Bald Knob, two and one-fourth miles south of Lola, Golconda Quadrangle, Livingston County, Kentucky.
45. Foot of hill, one and one-half miles northwest of Hampton, Golconda Quadrangle, Livingston County, Kentucky.
46. Golconda, Golconda Quadrangle, Hardin County, Illinois.
47. Locality no. 2, Golconda, Golconda Quadrangle, Hardin County, Kentucky.
48. Three and three-fourths miles northeast of Cave-In-Rock, Ford's Ferry Quadrangle, Hardin County, Illinois.
49. Four miles north of Marion, Crittenden County, Kentucky.
50. Three fourths of a mile southeast of Scottsburg, Princeton Quadrangle, Caldwell County, Kentucky.
51. One-fourth mile south of Bellbuckle school,

and three miles east-northeast of Scottsburg, Princeton Quadrangle, Caldwell County, Kentucky.

52. Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
53. Top of exposure of Okaw limestone in bluff on Cypress Creek on the Dongola-Vienna Road, Dongola Quadrangle, Union County, Kentucky.
54. Three and one-half miles southwest of Salem, Golconda Quadrangle, Livingston County, Kentucky.
55. Okaw limestone, between Menard and Fort Gage, Chester Quadrangle, Randolph County, Illinois.
56. Okaw limestone, two miles southwest of Ruma, Renault Quadrangle, Randolph County, Illinois.

M. (Charles Butts, 1917, p. 92) Composite list from Golconda, Pope County, Illinois, and Crittenden County, Kentucky.

N. (E. O. Ulrich, 1917, p. 220) Marion, Crittenden County, Kentucky.

O. (E. O. Ulrich, 1917, p. 220) Champion Hill, Livingston County, Kentucky.

P. (E. O. Ulrich, 1917, p. 220) One mile west of Claxton Station on the Louisville and Memphis Branch of the Illinois Central Railroad, Caldwell County, Kentucky.

Glen Dean Formation

57. Three-fourths of a mile northwest of Preston, Baldwin Quadrangle, Randolph County, Illinois.
58. Okaw (Plum Creek Beds), Baldwin Quadrangle, Randolph County, Illinois.
59. Menard, Chester Quadrangle, Randolph County, Illinois.
60. One and one-half miles northeast of Reevesville, Brownfield, Quadrangle, Johnson County, Illinois.
61. Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
62. Two miles east-southeast of Scottsburg, Princeton Quadrangle, Caldwell County, Kentucky.
63. Cloverport, Breckinridge County, Kentucky.
64. Glen Dean, Breckinridge County, Kentucky.

R. (Charles Butts, 1917, p. 98) Largely from Breckenridge County, Kentucky.

S. (E. O. Ulrich, 1917, p. 226) Vicinity of Smith, Livingston County, Kentucky.

T. (E. O. Ulrich, 1917, p. 226) Belleville Spring, seven miles north of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.

U. (E. O. Ulrich, 1917, p. 226) Near Grayson Springs, Grayson County, Kentucky.

V. (E. O. Ulrich, 1917, p. 226) Sloan's Valley, Pulaski County, Kentucky.

W. (E. O. Ulrich, 1917, p. 226) Kentucky species so far identified in western Illinois.

AA. (J. M. Weller, 1927, p. 137) Several localities in Edmonson County, Kentucky.

Vienna Formation

65. Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.

Menard Formation

66. Menard, Chester Quadrangle, Randolph County, Illinois.
67. Two and one-half miles south of Chester, Chester Quadrangle, Randolph County, Illinois.
68. One mile south of Chester, Chester Quadrangle, Randolph County, Illinois.
69. Campbellhill Quadrangle, northeast quarter, northeast quarter, Section 3, Township 85, Range 6 west.
70. Middle Menard, Blanchard Place, three and one-half miles north of Golconda, Brownfield Quadrangle, Pope County, Illinois.
71. Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
72. One-fourth mile west of Locality no. 72.
73. Three miles north of the Black Sulphur School, and eight and one-half miles north of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
74. Three miles north of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.
75. (Uncertain whether Menard or Clore). Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.

BB. (Charles Butts, 1917, p. 108) Composite list from Pope and Hardin Counties, Illinois.

CC. (E. O. Ulrich, 1917, p. 233) One to two miles west of Claxton Station on the Louisville and Memphis Branch of the Illinois Central Railroad, Caldwell County, Kentucky.

Clore Formation

76. Three and one-half miles east of Chester, Chester Quadrangle, Randolph County, Kentucky.
77. Macs Creek Hill, five and three-fourths miles northeast of Vienna, Vienna Quadrangle, Johnson County, Illinois.
78. Four and one-half miles northeast of Vienna, Vienna Quadrangle, Johnson County, Illinois.
79. Two miles northeast of Waltersburg, Brownfield Quadrangle, Pope County, Illinois.

DD. (Charles Butts, 1917, p. 111) Chiefly from Hardin County, Illinois.

EE. (E. O. Ulrich, 1917, p. 236) Claxton Station on the Louisville and Memphis Branch of the Illinois Central Railroad, Caldwell County, Kentucky.

FF. (Stuart Weller, 1927, p. 78) Northeast of Pilot Knob, four miles southeast of Marion, Kentucky.

KINKAID FORMATION

80. One quarter mile northwest of Carrsville Golconda Quadrangle, Livingston County, Kentucky.
81. Walche's Cut on the Louisville and Memphis Branch of the Illinois Central Railroad, five miles east of Princeton, Princeton Quadrangle, Caldwell County, Kentucky.

BUFFALO WALLOW FORMATION

GG. (Charles Butts, 1917, p. 115) Vicinity of Cloverport, Breckinridge County, Kentucky. The horizon from which the collection was made is from 70 to 80 feet above the top of the Tar Spring sandstone.

REFERENCES

BUTTS, CHARLES, *1917*, Description and correlation of the Mississippian formations of western Kentucky: *Kentucky Geol. Survey*, ser. 4, 119 pp.

——, *1922*, The Mississippian series of eastern Kentucky: *Kentucky Geol. Survey*, ser. 6, vol. 7, 188 pp.

GIRTY, G. H., *1915*, Invertebrate paleontology of the Pennsylvanian of Missouri: *Missouri Bur. Geol. and Mines*, ser. 2, vol. 13, pp. 263–376.

MERRILL, GEORGE P., *1905*, Catalogue of the type and figured specimens of fossils, minerals, rocks, and ores in the Department of Geology of the United States National Museum: *U. S. Nat. Mus. Bull.* 53, pt. 1, 370 pp.

NICKLES, J. M., and BASSLER, R. S., *1900*, A synopsis of American fossil bryozoa including bibliography and synonymy: *U. S. Geol. Survey Bull.* 173, 663 pp.

STOUDER, R. E., *1938*, The Chester rocks of Meade, Hardin, and Breckinridge counties, Kentucky: *Am. Assoc. Petroleum Geologists Bull.*, vol. 22, no. 3, pp. 505–563.

ULRICH, E. O., *1890*, Paleozoic bryozoa: *Illinois Geol. Survey*, vol. 8, pp. 253–282.

——, *1917*, The formations of the Chester series in western Kentucky and their correlates elsewhere: *Kentucky Geol. Survey*. ser. 4, 271 pp.

WELLER, J. MARVIN, *1927*, The geology of Edmonson County, Kentucky: *Kentucky Geol. Survey*, ser. 6, vol. 28, 237 pp.

WELLER, STUART, *1920*, Geology of Hardin County, Illinois: *Illinois Geol. Survey, Bull.* 41, 416 pp.

——, *1923*, Geology of the Princeton Quadrangle; *Kentucky Geol. Survey*, ser. 6, vol. 10, pp. 1–113.

——, *1927*, Geology of the Cave-In-Rock Quadrangle: *Kentucky Geol. Survey*, ser. 6, vol. 26, pp. 1–128.

MANUSCRIPT RECEIVED BY THE EDITOR DECEMBER 11, 1940.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 459–460, PL. 69, JULY 1942

A NEW UNIO FROM THE MORRISON FORMATION OF THE GRAND RIVER VALLEY, COLORADO

EDWARD L. HOLT
Mesa College, Grand Junction, Colo.

ABSTRACT—Most specimens of Unionidae from the Jurassic of North America are poorly preserved molds and casts. A new species of Unionidae herein figured and described is exceptionally well preserved.

IN A REVIEW of the Morrison fresh-water invertebrates, Branson[1] lists eight localities from which collections have been made. They are Mayeworth, Wyoming; Canon City, Colorado; Black Hills, South Dakota; Freezeout Hills, Wyoming; southwestern Wyoming; Como Bluffs, Wyoming; Tensleep, Wyoming; and the Wind River Mountains, Wyoming. No mention is made of the Grand Valley district of Colorado, although invertebrates have been mentioned in the literature by several workers.

The field work for this report was done during the spring of 1940. The study of the fossils and literature was completed in the summer of 1940, and a description of the fauna was incorporated in a Master's dissertation at the University of Colorado.

Typical Morrison invertebrates collected by the writer from the Grand Junction, Colorado, district include such forms as *Valvata scabrida* Meek and Hayden, *Vorticifex stearnsi* White, and in new species of Unionidae described in this article.

The Morrison fauna in the Grand Valley district occurs at two distinct horizons, one near the top of the formation, about 115 feet below the Dakota sandstone, and the other near the bottom, about 80 feet above the Entrada sandstone.

The top horizon contains *Valvata scabrida* Meek and Hayden. These fossils occur in great numbers in a limestone stratum about 6 inches thick. The fossils occur as silicified casts. Some are agatized; others are formed of jasper and chalcedony.

The *Valvata scabrida* horizon is best displayed about a mile west of the Fruita, Colorado, golf course. The limestone stratum in which the fossils occur is of limited extent and can be traced only a few hundred feet to the place where it interfingers with red shale. The writer has collected some specimens on Riggs, Hill, about eight miles east of the Fruita golf course.

The fossil horizon near the base of the Morrison contains *Vorticifex stearnsi* White, and large numbers of Unionidae.

Acknowledgements.—The writer wishes to thank Dr. W. C. Toepelman of the University of Colorado for many valuable suggestions and criticisms of the original manuscript.

SYSTEMATIC DESCRIPTIONS

Family UNIONIDAE

Genus VETULONAEA

VETULONAEA FABERI

Holt, n. sp.
Plate 69, figures 1–5

Shell thick, subovate, length greater than height; beaks almost terminal, moderately elevated, curved inward and forward—very blunt. The umbo is flat, distinctly set off from the rest of the shell, and ornamented by five to seven concentric wrinkles. The wrinkles do not extend in front of the beak. Area back of the beaks and paralleling the hinge is distinctly flattened. The hinge margin is a broad arch, bearing, on right valve, a long lateral tooth, which fits into a socket between the two linear teeth on the left valve. The right valve bears a nearly triangular socket beneath the beak and a strong pseudocardinal tooth below and in front of the socket. The left valve has a large triangular tooth above and behind a small deep socket The anterior muscle scar is oval and lies near the anterior margin beneath the bulge. The posterior muscle scar is oval, deep, and lies near the hinge at the beginning of the abrupt posterior slope of the dorsal margin. Pallial line is well marked and extends from ante-

[1] Branson, C. C., Fresh-water invertebrates from the Morrison (Jurassic?) of Wyoming: *Jour. Paleontology*, September, 1935, p. 515.

rior adductor to posterior adductor in a broad curve. Lunule present. Ligament opisthodetic. Undulations, one on each valve, just below and paralleling the hinge line. Hinge plate much thickened.

Dimensions of holotype: Height, 40 mm.; length, 55 mm.; thickness, 27 mm. Paratypes vary in length from 46 mm. to 79 mm.

Remarks—The new species herein described is similar in general shape and form to *Vetulonala whitei* Branson, but may be distinguished from it by the following characteristics:

Vetulonaea whitei

1. 9–11 concentric wrinkles on beak.
2. 20 radial undulations occupy the ventral portion of the posterior side of umbo.
3. These radial undulations increase by intercalation and form sharp nodes where they cross the growth lines.
4. Posterior muscle scar is circular and shallow.

Vetulonaea faberi

1. 5 to 7 concentric wrinkles on beak.
2. One pronounced undulation on each valve, just below and parallel to hinge line.
3. No nodes present.
4. Posterior muscle scar elliptical and deep.
5. Area back of the beaks paralleling the hinge line distinctly flattened.

The flattened area back of the beaks along the hinge line is regarded by the writer as especially peculiar to this new species.

Almost all Morrison species of Unionidae are known from shape alone. The type specimen of *Vetulonaea faberi* is remarkable in its excellent preservation of shell material. The periostracum is well preserved and retains the black color seen in living molluscs.

Occurrence.—The type locality of *Vetulonaea faberi* is on the Ladder Canyon road about six miles south of Grand Junction, Colorado. Specimens have also been collected from the Rim Rock Drive in Colorado National Monument at a point in the road cut about three miles south of Park Headquarters. Specimens are numerous at both places but occur in greater abundance at the type locality.

The specimens occur in a gray calcareous shale in the basal beds of the Morrison formation, about 80 feet above the Entrada sandstone. Associated with the fossils at the type locality are large numbers of *Vorticifex stearnsi* whitei.

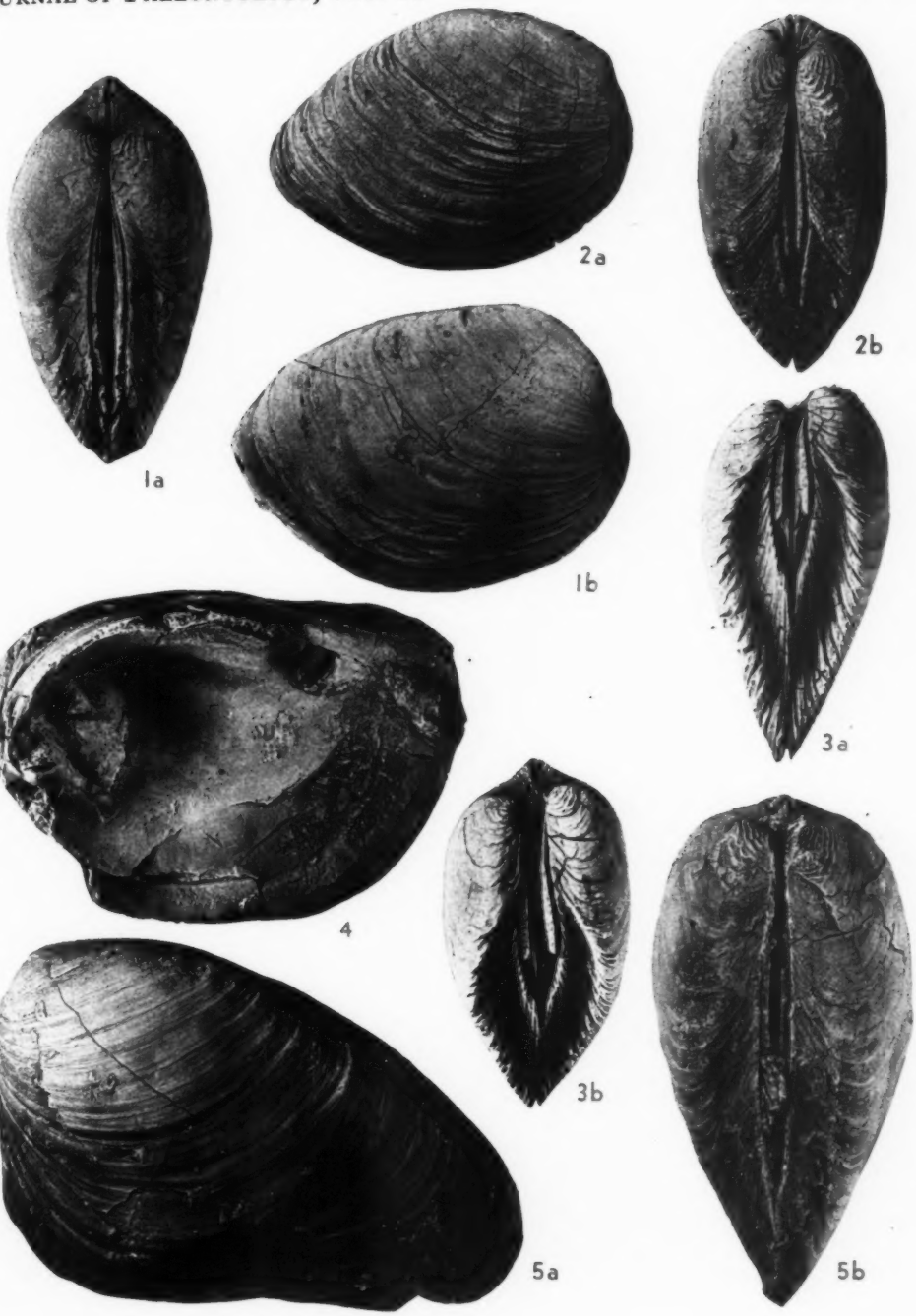
Types.—The holotype has been deposited with the University of Colorado, and paratypes with the United States National Museum.

MANUSCRIPT RECEIVED BY THE EDITOR JANUARY 31, 1941.

EXPLANATION OF PLATE 69

All figures natural size

FIGS. *1a–5b*—*Vetulonaea faberi* Holt, n. sp. *1a–b*, Dorsal and side views of holotype, University of Colorado Mus., no. 19174. *2a–b*. Paratype, side and dorsal views, showing concentric wrinkles on beak, *3a–b*. Dorsal views of paratype, showing characteristic broad undulations on both sides of the hinge. Figures 2 and 3 are from the U. S. Nat. Museum, no. 103262. *4*, Internal view of right valve, paratype, showing muscle scar. *5a–b*, Side and dorsal views of an unusually large paratype. Figures 4 and 5 are in the University of Colorado Mus., no. 19174. (p. 459)



Holt, Morrison Unionids

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 461–463, PL. 70, JULY 1942

SOME MIOCENE FORAMINIFERA FROM SUBSURFACE STRATA OF COASTAL TEXAS[1]

J. B. GARRETT
Stanolind Oil and Gas Company, Houston, Texas

ABSTRACT—The purpose of the paper is to describe characteristic species occuring in the debatable strata which have in the past been confused with typical *Discorbis* zone. Seven species of smaller foraminifera are figured from Miocene subsurface beds of Galveston County, in southeastern Texas. Six of these species are described as new. A short discussion of their stratigraphic significance is presented.

OVER MOST of the Texas Gulf Coast the identity of the *Discorbis* zone is agreed upon by micropaleontologists working in that area. However, such is not the case in a narrow strip some twenty to thirty miles wide bordering the coast line of southeastern Texas.

Through this belt there is considerable variance in the definition of the top of the *Discorbis* zone by different workers. This confusion appears to result because a section of more than 1,000 feet, which overlies beds equivalent to the up-dip *Discorbis* zone, is fossiliferous in the coastal strip, whereas it is not fossiliferous, or only poorly so, inland from the coast. The microfauna of these younger beds is very similar to that of the typical *Discorbis* zone, but can be distinguished from it.

Siphonina davisi Cushman and Ellisor ranges through the lower two-thirds of the section being considered, and is ordinarily quite common there. The purpose of this paper is to describe additional distinctive species of foraminifera occurring in these strata.

Although these beds are here considered to be Miocene in age, it should be noted that equivalence with any of the known Miocene outcrops of Florida is not implied. Many of the subsurface Miocene horizons of Texas and Louisiana probably are not represented by fossiliferous surface exposures anywhere in the Gulf Coast.

All specimens figured herein were obtained from cores from Stanolind Oil and Gas Company wells in the High Island field, Galveston County, Texas. This field is located near the eastern end of Bolivar Peninsula, in the most eastern extremity of Galveston County, and lies almost in the Gulf of Mexico.

Grateful acknowledgment is made to Dorothy K. Palmer, who kindly supplied specimens of *Planulina alavensis* Palmer, and to M. B. Stephenson, who devoted much care to preparing the figures.

The type specimens will be deposited in the geological museum at Louisiana State University. A duplicate set will be placed in the Cushman Laboratory for Foraminiferal Research, Sharon, Massachusetts.

SYSTEMATIC DESCRIPTIONS

Family REOPHACIDAE

Genus REOPHAX Montfort

REOPHAX sp.

Plate 70, figure 7

This form is scarcely distinctive enough to merit a specific name. Being unusual in the Miocene of Texas, its occurrence is worthy of note. Tests ordinarily consist of two to three chambers, composed of comparatively large sand grains. The aperture is very obscure.

Dimensions of specimen no. 2409 from no. 1 Gordon-Viterbo, core at 4,875–4,895 feet: length, 0.90 mm.; width, 0.40 mm.

Family LAGENIDAE

Genus LENTICULINA Lamarck

LENTICULINA HANSENI Garrett, n. sp.

Plate 70, figures 9, 10a–b

Test of moderate size, somewhat compressed, especially in the later chambers, close coiled in the early portion, tending to uncoil in the later portion; periphery moderately acute, with a rudimentary keel; usually eight to nine visible chambers in the adult; sutures distinct, curved, limbate,

[1] Published with the permission of the Stanolind Oil and Gas Company.

ornamented with rounded beads in the close coiled portion of the test; in the uncoiled portion these beads become elongated in a direction more or less parallel to the periphery; wall smooth except for the beaded sutures; apertural face smooth; aperture radiate, with a short tapering neck.

Dimensions of specimens from no. 1 Gordon-Viterbo, core at 4,875–4,895 feet; Syntype no. 2402; length, 1.26 mm.; width, 0.68 mm.; thickness, 0.45 mm. Syntype no. 2403; length, 0.95 mm.; width, 0.58 mm.; thickness, 0.37 mm.

Remarks—Lenticulina hanseni is similar to *L. jeffersonensis* Garrett, to which it probably is related. *L. hanseni* differs principally in having a well developed uncoiled portion, practically no keel, and distinct, elongate sutural ornamentation in the later portion of the test. Named for Mr. Malcolm Hansen.

Family BULIMINIDAE
Genus BOLIVINA d'Orbigny
BOLIVINA GLADIUS Garrett, n. sp.
Plate 70, figures 8a–b

Test small, compressed, elongate, slender, with almost parallel edges; periphery with a very narrow, fragile keel of clear material, best developed in the earlier portion of the test; chambers small, numerous; sutures fine, distinct, curved, slightly depressed; wall translucent, finely but very densely perforate, smooth in the later half of the test, ornamented by distinct, raised, parallel, longitudinal costae in the earlier half; aperture elongate.

Dimensions of holotype no. 2406 from no. A-15 Smith, core at 6,169–6,175 feet: length, 0.53 mm.; width, 0.14 mm.; thickness, 0.09 mm.

Remarks—Bolivina gladius resembles *B. cookei* Cushman, but differs in being more slender, in having fewer and more distinct longitudinal costae, and in having a peripheral keel.

BOLIVINA WESTI Garrett, n. sp.
Plate 70, figures 6a–b

Test very small, compressed; periphery rounded; chambers numerous, fairly distinct except in the early portion of the test; sutures only moderately distinct, curved in general outline but irregular in detail, slightly raised in the earlier portion of the test, slightly depressed in the later portion; wall thin, translucent, finely but extremely densely perforate, obscuring the details of chambers and sutures; aperture elongate.

Dimensions of holotype no. 2407 from no. A-15 Smith, core at 5,632–5,638 feet: length, 0.30 mm.; width, 0.13 mm.; thickness, 0.08 mm.

Remarks—This small form appears to be distinct from any described species. Named for Mr. Frank West.

Family ROTALIIDAE
Genus DISCORBIS Lamarck
DISCORBIS BOLIVARENSIS Garrett, n. sp.
Plate 70, figures 1a–c, 2

Test rather large for the genus, moderately compressed, dorsal side somewhat convex, ventral side umbilicate; periphery moderately acute, lobulate in the later portion of the test; chambers distinct, averaging seven in number in the final whorl, last two

---

EXPLANATION OF PLATE 70

FIGS. *1a–c, 2—Discorbis bolivarensis* Garrett, n. sp. *1a*, Dorsal view; *1b*, ventral view; *1c*, apertural view, holotype no. 2404, ×50. *2*, Dorsal view, paratype no. 2405, ×50. Miocene, Texas. (p. 462)

3a–c, 4—Planulina palmerae Garrett, n. sp. *3a*, Side view; *3b*, opposite side view; *3c*, apertual view, holotype no. 2400, ×70. *4*, Side view, paratype no. 2401, ×70. Miocene, Texas. (p. 463)

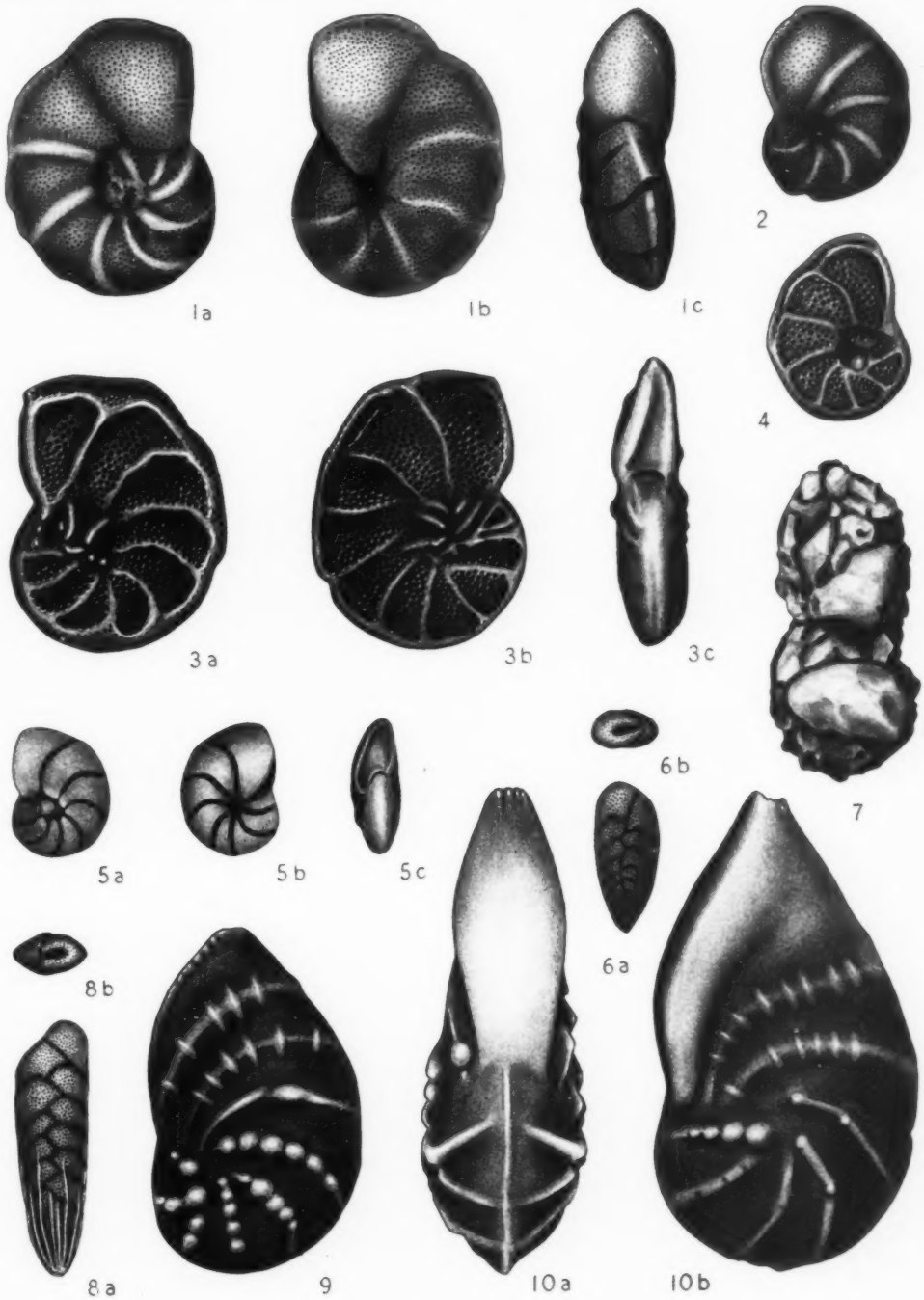
5a–c—Cibicides steini Garrett, n. sp. *5a*, Dorsal view; *5b*, ventral view; *5c*, apertural view, holotype no. 2408, ×60. Miocene, Texas. (p. 463)

6a–b—Bolivina westi Garrett, n. sp. *6a*, Side view; *6b*, apertural view, holotype no. 2407, ×70. Miocene, Texas. (p. 462)

7—Reophax sp. Side view, specimen no. 2409, ×50. Miocene, Texas. (p. 461)

8a–b—Bolivina gladius Garrett, n. sp. *8a*, Side view; *8b*, apertural view, holotype no. 2406, ×70. Miocene, Texas. (p. 462)

9, 10a–b—Lenticulina hanseni Garrett, n. sp. *9*, Side view, syntype no. 2403, ×50. *10a*, Apertural view; *10b*, side view, syntype no. 2402. ×50. Miocene, Texas. (p. 461)



Garrett, Miocene Foraminifera

UNIV. OF MICH.

to four chambers weakly inflated dorsally; sutures distinct, slightly curved, limbate, slightly raised except for final one or two sutures, which are somewhat depressed; wall smooth, finely punctate; aperture on the umbilical side of the periphery, with a slightly overhanging lip.

Dimensions of specimens from no. 1 Gordon-Viterbo, core at 4,875–4,895 feet: Holotype no. 2404; maximum diameter, 0.77 mm.; thickness, 0.25 mm. Paratype no. 2405; maximum diameter, 0.53 mm.; thickness, 0.22 mm.

Remarks—Discorbis bolivarensis is similar to *D. gravelli* Garrett, of which it may be a descendant. However, even in fully adult specimens the inflation of *D. bolivarensis* never approaches that of typical *D. gravelli*. It is often impossible to distinguish the young forms of these two species.

Family ANOMALINIDAE
Genus PLANULINA d'Orbigny
PLANULINA PALMERAE Garrett, n. sp.
Plate 70, figures 3a–c, 4

Test rather small, compressed, planispiral, with the same number of chambers visible on either side; periphery subacute, slightly lobulate, with a narrow keel of clear material; chambers distinct, usually eight to nine in the final whorl; sutures moderately raised throughout, slightly curved and limbate; wall coarsely perforate, with sutures in high relief, and often having a peculiar metallic luster; aperture a low arched opening at the base of the final chamber; also obscure secondary apertures apparently occurring on the peripheral margin of each chamber.

Dimensions of specimens from no. A-15 Smith, core at 6,059–6,061 feet: Holotype no. 2400; maximum diameter, 0.56 mm.; thickness, 0.13 mm. Paratype no. 2401; maximum diameter, 0.37 mm.; thickness, 0.08 mm.

Remarks—Planulina palmerae resembles *P. alavensis* Palmer, to which it is no doubt closely related. *P. palmerae* differs in being thicker, in having sutures which are more curved and more strongly raised, and in having a much poorer development of Palmer's "supplementary peripheral apertures." These supplementary apertures are not readily noticed in *P. palmerae*.

Named in honor of Mrs. Dorothy K. Palmer, for her scholarly work on *Planulina alavensis*.

Genus CIBICIDES Montfort
CIBICIDES STEINI Garrett, n. sp.
Plate 70, figures 5a–c

Test very small, plano-convex, compressed; periphery subacute; chambers distinct, usually eight to ten in the final whorl; sutures fine, dark, distinct, with marked curvature; umbilical region on both sides filled with clear material; wall smooth, with punctations so fine as to be almost imperceptible; aperture a low arched peripheral opening.

Dimensions of holotype no. 2408 from no. A-15 Smith, core at 6,169–6,176 feet: maximum diameter, 0.30 mm.; thickness, 0.08 mm.

Remarks—This small species has much in common with forms often referred to *Cibicides americanus* (Cushman). However, *C. steini* is smaller and more delicate than *C. americanus*, and differs in finer details of structure. Named for Mr. F. B. Stein.

REFERENCES

APPLIN, E. R., ELLISOR, A. C., and KNIKER, H. T., *1925*, Subsurface stratigraphy of the Coastal Plain of Texas and Louisiana: *Am. Assoc. Petroleum Geologists Bull.*, vol. 9, pp. 79–122.

CUSHMAN, J. A., *1918*, Some Pliocene and Miocene Foraminifera of the Coastal Plain of the United States: *U. S. Geol. Survey Bull.*, no. 676, pp. 63–64, pl. 20, figs. 2, 3, pl. 21, fig. 1.

——, *1922*, The Foraminifera of the Mint Spring calcareous marl member of the Marianna Limestone: *U. S. Geol. Survey. Prof. Paper* 129-F, p. 126, pl. 29, fig. 1.

——, and ELLISOR, A. C., *1939*, New species of Foraminifera from the Oligocene and Miocene: *Cushman Lab. Foram. Research Contr.*, vol. 15, pt. 1, pp. 10–11, pl. 2, fig. 3.

GARRETT, J. B., *1939*, Some middle Tertiary smaller Foraminifera from subsurface beds of Jefferson County, Texas: *Jour. Paleontology*, vol. 13, no. 6, p. 578, pl. 66, figs. 2, 3.

PALMER, DOROTHY K., *1938*, *Planulina alavensis*, a new Cuban Oligocene foraminifer: *Soc. Cubana de Historia Natural Memorias*, vol. 12, no. 5, pp. 345–346.

MANUSCRIPT RECEIVED BY THE EDITOR FEBRUARY 14, 1941.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 464–470, PLS. 71, 72, JULY 1942

WORTHENELLA, SETIGERELLA, AND NEW PRODUCTID SPECIES

A. H. SUTTON
University of Illinois, Urbana, Illinois

ABSTRACT—*Marginicinctus* Sutton is rejected as a synonym of *Worthenella* Girty, which is raised from subgeneric to generic status. Reasons are given for not considering *Setigerella* Girty as a valid subgenus or genus. Six new species of Productidae, assigned three to *Avonia*, two to *Dictyoclostus*, and one to *Buxtonia*, are described.

THE GENUS WORTHENELLA

DR. GEORGE H. GIRTY (1938, p. 434, 442) proposed two new subgenera of Productidae; *Setigerella*, with *Productus setigerus* Hall as the genotype, and *Worthenella*, with *Productus wortheni* Hall as the genotype. The latter includes two species, *P. wortheni* and *P. marginicinctus* for which I (1938, p 561) proposed the new genus *Marginicinctus* with *Productus marginicinctus* Prout as the genotype. Since Girty's publication preceded mine by a few days, bearing the date of October 15, 1938 and mine the date of November, 1938, the name *Marginicinctus* should be suppressed as a synonym of *Worthenella*. Although *Marginicinctus* was proposed as a generic and *Worthenella* as a subgeneric name this has no bearing on the validity of the names since the International Rules of Zoological Nomenclature, Article 6, states.

> Generic and subgeneric names are subject to the same rules and recommendations, and from a nomenclatural standpoint they are co-ordinate, that is they are of the same value.

Neither does the date of receipt of manuscript, December 29, 1937 for mine and August 8, 1938 for Girty's have any bearing on the priority of the names. It is recommended that *Worthenella* Girty be raised from subgeneric to generic status.

THE GENUS SETIGERELLA

In my opinion Girty's other new subgenus, *Setigerella*, should not be considered valid because it was founded on a character which is possessed in varying degrees by more than one type of Productidae. The feature which he stressed as of subgeneric (or generic) significance is the reflected border around the lateral and anterior margins of the valves of some mature individuals. In the genotype, *setigera*, this forms a trough or gutterlike structure (Pl. 72, figs. 12, 13). Not all known specimens of the species show this structure although Girty described it from several. I have several specimens of Productidae from the Moorefield formation of Oklahoma, presented to me by C. L. Foster of Norman, Oklahoma, which possess this feature developed to such a degree that the reflected margins of the valves are extended until they are almost in contact with the ventral valve some distance posterior to the farthest extent of the shell, forming a tubelike border, (Pl. 71, figs. 1, 2, 8–11 and Pl. 72, figs. 1–3). Except for the reflected border these specimens exhibit no characters which would differentiate them from other species of *Dictyoclostys*, to which genus they are assigned. Some of them, insofar as has been determined, are conspecific with described species of that genus, *D. crawfordsvillensis*, *D. cherokeensis*, and *D. coloradoensis*. In addition, two new species, *D. fosteri* and *D. manardensis* are among these specimens. On all of these forms the border structure is smooth, lacking the characteristic surface ornamentation of the remainder of the valves.

The extent of the backward-turned portions of the valves varies. In *Dictyoclostus fosteri* Sutton, n. sp. the ventral valve is turned upward to form a trough around the margin and the dorsal is curved back far enough to meet the edge of the ventral. On *D. manardensis* Sutton, n. sp. both valves appear to be present throughout the extent of the tubelike border. Most specimens of the other species appear to be more like *D. manardensis* in the nature of the extension of the valves. This same feature is also well displayed by a specimen of *Dictyoclostus americanus* from the Pennsylvanian (Pl. 71, figs. 12, 13). On this specimen the valves are

turned up at rather a sharp angle to form a definite trough but not a tubelike structure as on the Mississippian specimens of *Dictyoclostus*. Furthermore the radial markings extend over the reflected portion of the ventral valve. The border of the dorsal valve has been destroyed so it is not possible to determine whether or not it possessed surface ornamentation. The same type of structure, although developed to a lesser extent, has been noted on a specimen of *Linoproductus altonensis* from the Mississippian rocks (Pl. 72, figs. 9–11). On this specimen the reflected edges of the valves form more of an extension at right angles to the surface of the ventral valve than a trough or tube. Radial surface markings are preserved on part of the reflected portion of the dorsal valve but preservation of the ventral valve is not sufficiently good to determine whether radial markings are present or not. Presumably they are.

This marginal feature, because of its development in varying degrees among at least three different types of Productidae in the Mississippian and Pennsylvanian, does not seem to be of generic (or subgeneric) or even specific taxonomic value. It has never been reported on any but mature individuals and may be a gerontic feature not often noted because seldom preserved, or it may be associated with large individuals which inhabited some particular environment although it is not known what that environment may have been. It is difficult to envisage what value the structure may have possessed for the individuals possessing it. Most of the specimens with this marginal feature that have been examined were collected from siliceous limestones but some are from chert and others from shale beds.

Other productid genera (or subgenera) which have been established on the possession of some particular feature associated with the lateral or anterior portions of the valves as the diaphragm of the dorsal valve of *Productus* s.s., the marginal ridge around the visceral disc of the dorsal valve of *Marginifera*, the marginal thickening of the lateral and anterior portions of the visceral disc of the dorsal valve of *Marginirugus*, and the transverse fold or arch on the ventral valve of *Worthenella* are confined in each genus to one kind of productid and the diagnostic feature can be correlated with certain other constant biocharacters. In contrast, the marginal trough, groove, or tubelike structure of the subgenus *Setigerella*, as proposed by Girty, and the other forms herein considered, can not be correlated with any other particular character or set of characters but seems to have developed at different times only on mature individuals of different types of Productidae. Because of these facts it would seem unwise to establish any particular taxonomic category to include forms with such a reflected margin. Species possessing it should more properly be assigned to genera with which they agree in other essential characters. *Productus setigerus* is herein assigned to *Buxtonia* where it was previously placed (Sutton, 1938, p. 564).

NEW SPECIES OF PRODUCTIDAE

The following new species have been obtained from several sources. Some of them include specimens which have been for many years in the paleontological collections of the University of Illinois. The species of *Dictyoclostus* from the Mississippian rocks with the pronounced marginal structure were presented by C. L. Foster, formerly of Bacone College, Bacone, Oklahoma, and now at Norman, Oklahoma. *Avonia snowyensis*, n. sp., was collected by H. W. Scott from the Heath formation of the Big Snowy group, Mississippian, in Montana. Appreciation is expressed to these persons for the privilege of describing the new species. In the description of new forms, size is expressed in relative terms of large, medium, and small. Average or medium size has been arbitrarily selected as about 25 mm. or one inch in diameter.

SYSTEMATIC DESCRIPTIONS

Genus AVONIA Thomas, 1914

AVONIA SNOWYENSIS Sutton, n. sp.

Plate 72, figures 4–6

Shell less than medium in size, wider than long, hinge line slightly less than the greatest width and nearly three-fourths as great as the length. Dimensions of the holotype are: greatest length 16 mm., greatest width 20 mm., length of hinge-line 14 mm., and depth of curvature 8 mm. Ventral valve rather highly arched with the highest part about midway of the length. Surface slopes

steeply toward the lateral margins and more gently toward the beak and anterior margin. Beak slightly protuberant beyond the hinge line. Cardinal extremities rounded into the lateral margins. Auriculations small and poorly defined. Spines most abundant on the lateral slopes immediately anterior to the auriculations. Scattered spines distributed over the entire surface except the beak portion. On the middle portion of the shell there is a tendency for the spines to be arranged in poorly defined concentric rows. Incipient costae are visible around the anterior margin. Internal characters not observed. Dorsal valve unknown.

Remarks.—This species is about the size and shape of average specimens of *Avonia moorefieldana* (Girty), but possesses more spines and less development of radial costae than the latter species and may be rather closely allied to it since certain of the Big Snowy brachiopods are quite similar to some Mississippian forms of the Arkansas valley area.

Occurrence.—Heath formation, Big Snowy group, Mississippian, Big Snowy mountains, Fergus County, Montana. Collected by H. W. Scott.

Type.—The holotype and only known specimen is no. X-1324 in the University of Illinois paleontological collection.

AVONIA LINOSPINOSA Sutton, n. sp.
Plate 71, figures 5–7

Shell small, length somewhat greater than width, hinge line considerably shorter than the greatest width of the body of the shell. Dimensions of two nearly complete ventral valves, syntypes, are: length from umbonal region to anterior margin, 11 mm. and 8.5 mm., length of hinge line 7.5 mm. and 6 mm. maximum width of shell 8.6 mm., and 8.5 mm. Ventral valve highly arched, beak incurved over the hinge line and the umbonal region conspicuously protuberant beyond the hinge-line. The valve decreases uniformly and rapidly in width from the anterior margin to the beak. No mesial sinus. The surface curves very abruptly from the umbonal region to the cardinal extremities and lateral slopes, more gently to the anterior margin. Cardinal auriculations small and well defined. Surface ornamented with growth lines, radial costae, and spines. Costae occupy the anterior one-half to two-thirds of the shell and are of such a size that two occupy the space of 1 mm. They increase by intercalation. Intervening furrows about equal in width to the costae. Spines sparingly distributed over the entire surface of the valve except on the beak, which is smooth. Those on the noncostate portion of the shell are rather irregularly arranged, but on the costate part they occur in rather definite concentric rows or lines, each spine arising from a costa. Three or four rows of spines seems to be normal for the specimens studied. On some portions of the shell they arise from adjacent costae and on others from alternate costae. Internal characters not observed. Dorsal valve unknown.

Remarks.—This species resembles *Avonia pustulifera* Moore from the Sedalia and lower Burlington formations but may be distinguished from that species by the smaller number and regular arrangement of the spines on the costate portion of the shell and by the more acute shape of the ventral valve.

Occurrence.—Burlington limestone near Louisiana, Missouri.

Types.—Syntypes, University of Illinois collection, no. X-1325.

AVONIA MINUTA Sutton, n. sp.
Plate 71, figures 3, 4

Shell small, length and width approximately equal; hinge line only slightly less than the greatest width. Dimensions of the holotype are: length from beak to anterior margin 10 mm., length from hinge line to anterior margin 9 mm., greatest width of shell 10 mm., and length of hinge line 7 mm. Ventral valve not highly arched and with the umbonal region only slightly protuberant beyond the hinge line. The surface slopes rather steeply from the umbonal region to all margins, only slightly steeper toward the lateral margins than to the anterior. Cardinal auriculations small and not sharply defined. Surface ornamented with growth lines, radial costae, and spines. The low, rounded costae begin as very indefinite markings just anterior to the umbonal region and increase in number and definiteness toward the anterior and lateral margins, about three occupying the space of 1 mm. near the margins of the valve. The interven-

ing furrows are somewhat narrower than the costae. Spines sparingly developed over the entire surface and thickest along the lateral slopes just anterior to the auriculations. On the costate portion of the shell they spring from the costae. The incipient costae in the umbonal region are initiated by the elongate nodelike elevations of the spines. Conspicuous growth lines and incipient rugae are developed on the posterior portion of the shell. Internal characters not observed. Dorsal valve unknown.

Remarks.—This is one of the smallest costate *Avonias* reported from the Mississippian. It may be distinguished by its rather low convexity and nearly equal width and length. It possesses more costae than other forms of similar size.

Occurrence.—Burlington limestone, Augusta, Iowa.

Type.—Holotype, University of Illinois collection, No. X-1326.

Genus BUXTONIA Thomas, 1914
BUXTONIA FLOYDENSIS Sutton, n. sp.
Plate 72, figures 7, 8

Shell medium size, slightly broader than long, greatest width anterior to the middle of the shell. Hinge line relatively short. Dimensions of the holotype are: maximum width 29 mm., maximum length 25 mm., length of hinge line 16 mm., and convexity 11.5 mm. Ventral valve only moderately convex forming a medium depth visceral cavity. Greatest height of valve about one-third of the distance from the beak to anterior margin. Umbonal region only slightly protuberant beyond the hinge line. Beaks somewhat incurved. Umbonal region compressed laterally. Surface convex throughout its length. No median sinus. Surface slopes steeply from the umbonal region to the hinge line and lateral portions, more gently toward the anterior margin. Cardinal extremities curve rather abruptly into the lateral margins. Auriculations small and poorly defined. Surface covered with rounded costae except on two relatively narrow areas which extend from the cardinal extremities along the sides of the shell to points nearly midway of the length. The costae average two to one mm. with intervening furrows about equal in width to the costae. They begin at the hinge line and extend to the lateral and anterior margins of the shell, increasing in number chiefly by bifurcation but occasionally by intercalation. The two noncostate areas are thickly studded with spines. Elsewhere over the surface scattered spines arise from the costae. The valve is without rugae and growth lines are only faintly developed. Internal characters not observed.

Dorsal valve almost flat with a shallow mesial sinus in the posterior portion which becomes a low, poorly defined fold anteriorly, producing a slightly sinuate anterior margin. No trail. The surface is covered with radiating costae except on two triangular shaped areas, the posterolateral portions of the valve. The costae are in all essentials like those of the ventral valve. The two noncostate areas are covered with closely spaced spines. The remainder of the surface contains scattered spines which spring from costae. The anterior margins of both valves do not have a greater development of spines with consequent breaking down of the costae as is typical of *Buxtonia*, a feature which is probably more often associated with large and old individuals. Internal characters not observed.

Remarks.—This species is readily distinguishable from other described Mississippian *Buxtonias* because of its relatively low convexity and the two very spinose, noncostate areas on the posterolateral portions of each valve.

Occurrence.—Upper Borden (Keokuk) group, Floyd and Washington counties, Indiana.

Type.—Holotype, University of Illinois collection, no. X-1265.

Genus DICTYOCLOSTUS Muir-Wood, 1930
DICTYOCLOSTUS FOSTERI Sutton, n. sp.
Plate 72, figures 1–3

Shell above medium size, broader than long, the greatest width approximately at the midlength of the valves, visceral cavity relatively shallow for the genus. Dimensions of the holotype are: greatest length 36 mm., greatest width 47 mm., length of hinge line 38 mm., convexity of ventral valve approximately 15 mm., length along ventral valve from beak to anterior margin approximately 55 mm.

Ventral valve strongly convex with the posterior slope along the mid-line somewhat

steeper than on the anterior two-thirds of the mid length. The beak is only slightly protuberant beyond the hinge-line. Lateral slopes about as steep as the posterior. Auriculations small but well defined. No mesial sinus. Surface marked by poorly defined radial costae which are spaced about 1 mm. apart. They increase by intercalation and bifurcation toward the anterior portion of the shell. Intercostal furrows about equal in width to the costae. The inconspicuous character of the costae is in part due to partial exfoliation of the shell substance. The posterior portion of the shell is marked by definite although not conspicuous concentric rugae which are stronger on the lateral umbonal slopes and cardinal extremities. No large spines, but where the surface is partially exfoliated the inner portion is thickly studded with closely spaced papillose structures which apparently were not reflected on the outer shell layer. Fine growth lines are detectable over most of the valve. The margin of the valve appears to be upturned only enough to meet the reflected border of the dorsal valve which forms a tube-like structure.

Dorsal valve somewhat concave although the exact curvature of the holotype is difficult to determine because it has been split along the midline, compressed toward the ventral valve anteriorly, and pulled away somewhat from it along the hinge line. The degree of curvature seems to have been such that the shell possessed a moderately shallow visceral cavity for *Dictyoclostus*. The two valves were almost in contact throughout nearly one-half of their length. Surface markings consist of radial costae and concentric rugae similar to those of the ventral valve. The costae are much more conspicuous on the dorsal than on the ventral valve while the rugae are about the same. There are a few scattered spine bases on the dorsal valve. This valve possesses a conspicuous irregular, rolled ringlike border on the marginal portion of the shell. The unrolled portion is free of costae and spines, and on the holotype appears to be composed chiefly of an extension of the dorsal valve. Internal characters not observed.

Remarks.—This species is rather unusual for a *Dictyoclostus* because of the poorly developed costae and a dorsal valve somewhat more concave than is normal for the genus. However, the general shape of the ventral valve is normal and the concentric rugae are typical for the genus. Although the ringlike border has been emphasized in the description of this and the next described new species it should be understood that specimens exhibiting the other diagnostic characters should be included in these species even if the ringlike border were not developed.

Occurrence.—Moorefield formation. Sec. 20, T. 15 N., R. 20 E., near Bayou Manard, Oklahoma. Collected by C. L. Foster.

Type.—Holotype, University of Illinois collection, no. X-1327.

EXPLANATION OF PLATE 71

All illustrations natural size unless otherwise indicated

FIGS. *1, 2—Dictyoclostus crawfordsvillensis* (Weller), Moorefield formation, Bayou Manard, Oklahoma. Ventral and lateral views of a specimen with an almost complete border. Collected by C. L. Foster. U. of I. collection E-2329. (p. 464)

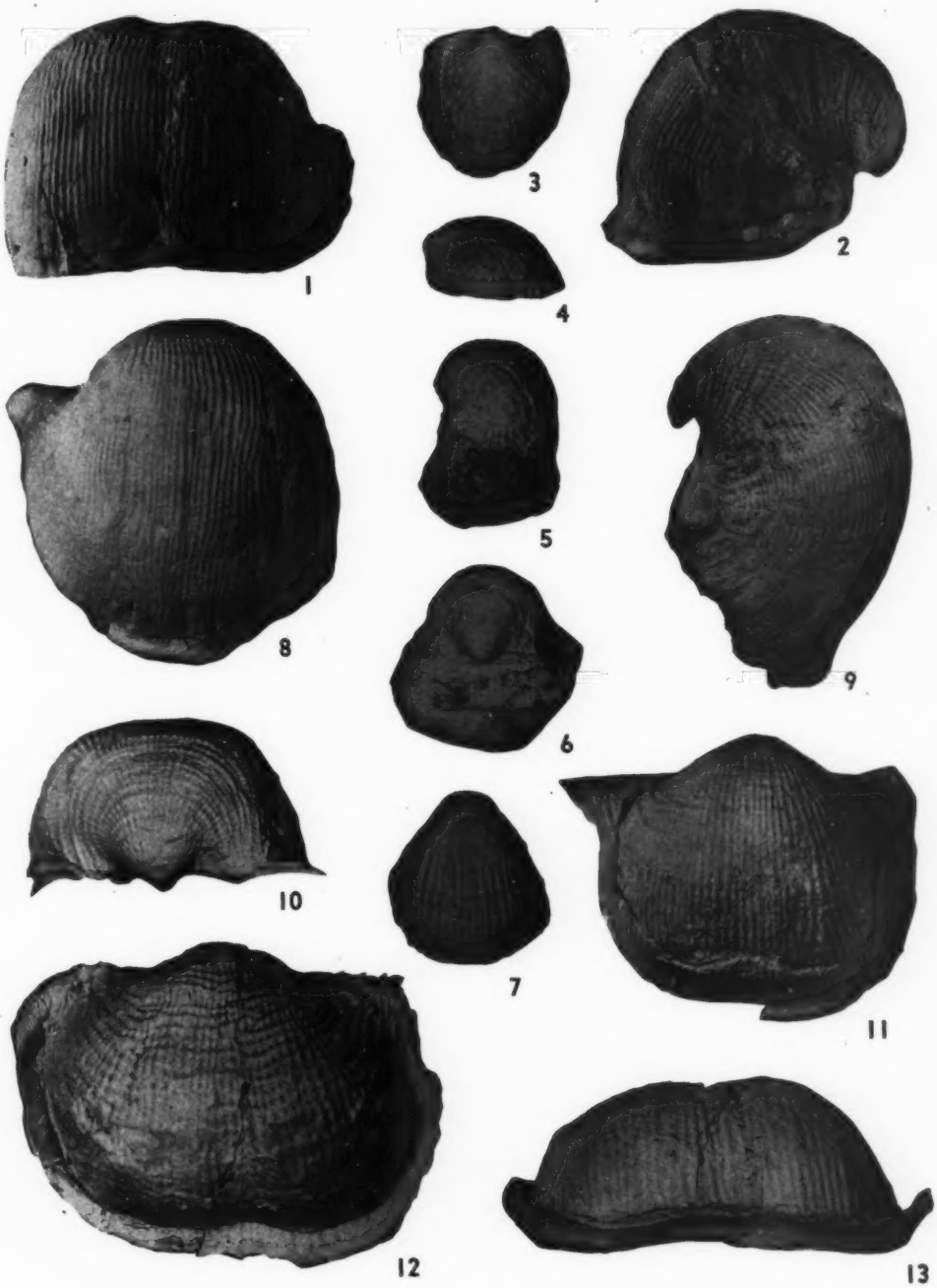
3, 4—Avonia minuta Sutton, n. sp., ×2. Ventral and lateral views of the holotype. Burlington limestone, Augusta, Iowa. U. of I. collection, X-1326. (p. 466)

5–7—Avonia linospinosa Sutton, n. sp., ×2. *5, 6*, lateral and posterior views of one of the syntypes. *7*, ventral view of another syntype, Burlington limestone, Louisiana, Missouri, U. of I. collection, X-1325. (p. 466)

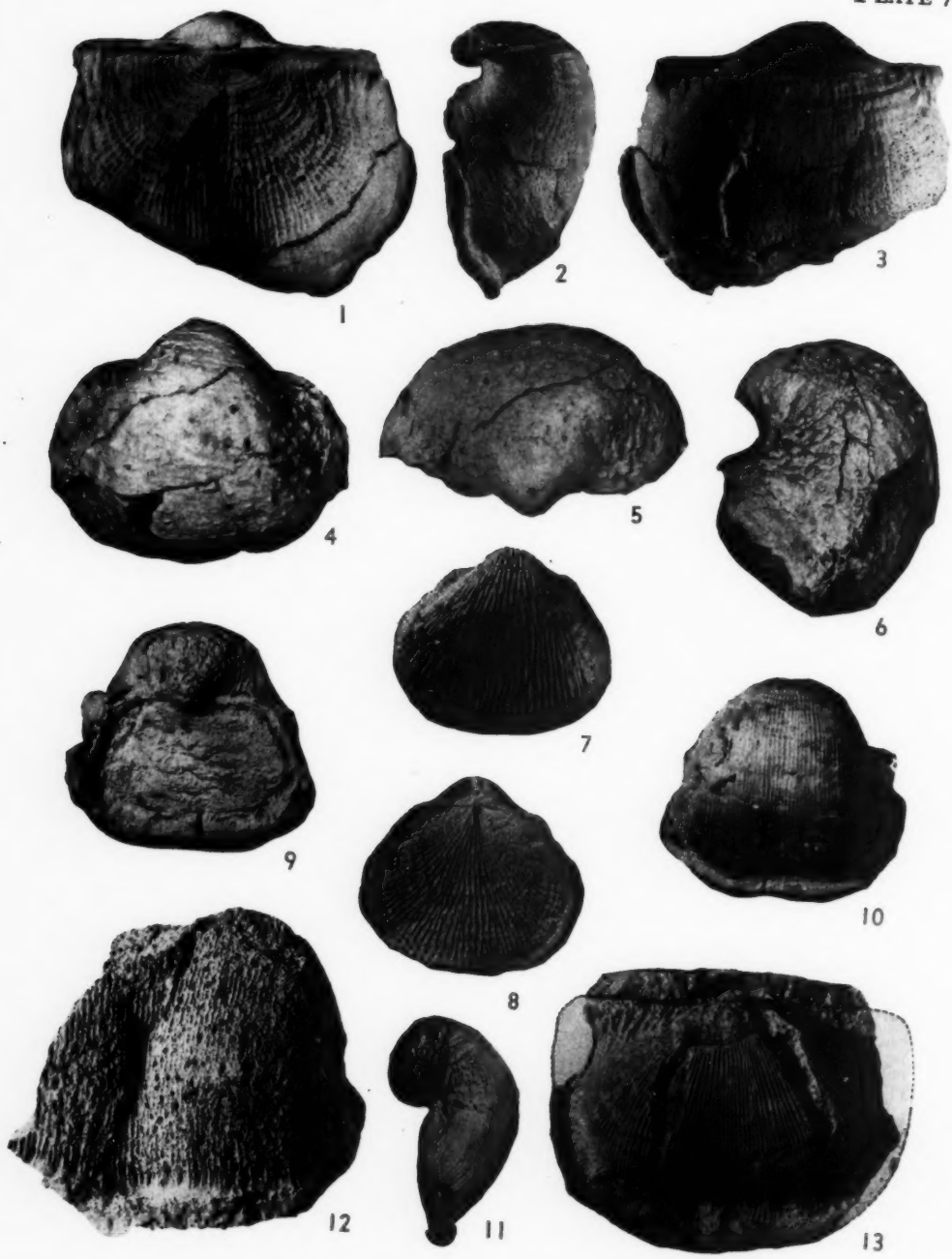
8–10—Dictyoclostus manardensis Sutton, n. sp. Ventral, lateral, and posterior views of the holotype from the Moorefield formation, Bayou Manard, Oklahoma. Collected by C. L. Foster. U. of I. collection, X-1328. (p. 469)

11—Dictyoclostus cherokeensis (Drake). Ventral view of a specimen from the Moorefield formation, Bayou Manard, Oklahoma, showing a well developed border. Collected by C. L. Foster. U. of I. collection, E-2330.

12, 13—Dictyoclostus americanus Dunbar and Condra. Specimen from the Carbondale, Peoria County, Illinois, with a very pronounced marginal structure. U. of I. collection, F-3994. (p. 464)



Sutton, Mississippian Productids



Sutton, Mississippian Productids

DICTYOCLOSTUS MANARDENSIS Sutton, n. sp.
Plate 71, figures 8–10

Shell above medium size, length and breadth approximately equal. Greatest width about equal to the hinge line. Visceral cavity relatively deep. Dimensions of an average specimen are: length 45 mm., width along the hinge-line 43 mm., length along the curvature of the ventral valve from beak to anterior margin 82 mm., convexity of valves approximately 21 mm.

Ventral valve strongly convex, the longitudinal curvature subgeniculate about one-third of the distance from beak to anterior margin, regularly and gently curved from that point to the anterior margin, somewhat flattened posterior to this point and then curved rather abruptly from the umbo to the beak. Lateral slopes steep. Auriculations well defined and of medium size. No definite sinus although a very shallow, poorly defined linear depression occurs along the longitudinal midline on some specimens. Beak area strongly protuberant beyond the hinge-line, one of the most important diagnostic characters of the species. Surface marked by well-defined, rounded costae, so spaced that the distance between the crests of two adjacent costae is about 1 mm. Intercostal furrows about equal in width to the costae. The costae increase in number chiefly by intercalation although occasional bifurcations occur. Concentric rugae well developed on the posterior one-third or less of the valve They are strongest on the lateral slopes but extend entirely across the valve. A few large spines occur along the hinge-line and scattered on the anterior portion of the valve. The marginal border of the ventral valve seems to be extended just about as far as that of the dorsal although this portion of the shell is so thin that it is difficult to detect the two valves separately in some of the border portion.

Dorsal valves in contact with ventral valves unknown, except for the remnants of dorsal valves in the tubelike border on some ventral valves. However, associated with the ventral valves, when collected, were some dorsal valves that probably represent the same individuals. They are nearly flat with only a broad, poorly defined fold-like undulation on the anterior portion corresponding to the poorly defined depression of the ventral valve. Surface with well-defined costae and rugae. The lateral and anterior margins of the valve are doubled back to form a tubelike border which may have extended somewhat beyond the backward turned edge of the ventral valve. The border of this species, like that on all of the specimens from the Moorefield is without surface ornamentation.

Occurrence.—Moorefield formation, Sec. 19, T. 15 N., R. 20 E., Bayou Manard, bluff and ravine, Oklahoma. Collected by C. L. Foster.

Remarks.—The most distinguishing feature of the species is the pronounced protuberance of the ventral valve beyond the hinge line. No other similar Mississippian species of *Dictyoclostus* possesses such a pronounced extension of the shell beyond the hinge line. It differs from its nearest allies, *D. cherokeensis*, *D. crawfordsvillensis*, and *D.*

EXPLANATION OF PLATE 72

All illustrations natural size unless otherwise indicated

FIGS. *1–3*—*Dictyoclostus fosteri* Sutton, n. sp. Dorsal, lateral, and ventral views of the holotype, Moorefield formation, Bayou Manard, Oklahoma. Collected by C. L. Foster. U. of I. collection, X-1327. (p. 467)

4–6—*Avonia snowyensis* Sutton, n. sp., ×2. Ventral, posterior, and lateral views of the holotype from the Heath formation, Big Snowy group, Big Snowy mountains, Fergus County, Montana. Collected by H. W. Scott. U. of I. collection, X-1324. (p. 465)

7, 8—*Buxtonia floydensis* Sutton, n. sp. Ventral and dorsal views of the holotype from the Keokuk, Floyd County, Indiana. U. of I. collection, X-1265. (p. 467)

9–11—*Linoproductus altonensis* (Norwood and Pratten). Dorsal, ventral, and lateral views of a specimen showing a shelflike border. Dorsal view does not show dorsal valve. St. Louis Limestone, no locality known. U. of I. collection, E-2328.

12, 13—*Buxtonia setigera* (Hall). Dorsal and ventral valves showing the marginal feature. After Girty (1938, figures 2 and 5). (p. 464)

coloradoensis in the absence of pronounced fold and sinus. It is also somewhat more acutely pointed posteriorly than any of those species.

Type.—Holotype, University of Illinois, no. X-1328.

REFERENCES

GIRTY, G. H., *1938*, *Setigerella* and *Worthenella*, two new subgenera of *Productus*: *Washington Acad. Sci. Jour.*, vol. 28, no. 10, October 15, pp. 433–443.

SUTTON, A. H., *1938*, Taxonomy of Mississippian Productidae: *Jour. Paleontology*, vol. 12, no. 6, pp. 535–569.

MANUSCRIPT RECEIVED BY THE EDITOR APRIL 4, 1941.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 471–478, PLS. 73, 74, JULY 1942

ORDOVICIAN TRILOBITES FROM NEVADA

SAMUEL HOLLIDAY
Cambridge, Massachusetts

ABSTRACT—Trilobites of the families Pliomeridae Öpik, and Cybelidae Holliday (new name for Encrinuridae) are described. *Pseudomera*, a new genus with *Amphion barrandei* Billings as its genotype, is proposed. *Pseudomera barrandei* is reported from north of Manhattan, Nevada, at Bassler's Ordovician sponge locality. *Pseudomera? nevadensis* (Walcott is reported from the above locality and from Hamilton, Nevada, the type locality of the Pogonip limestone. Comparison of type material shows that Phleger (1933) was mistaken in stating that *Pseudomera barrandei* and *P.? nevadensis* are identical *Niobe? feilleri*, n. sp., *Ectenonotus connemaricus* (Reed), *E. marginatus*, n. sp., *Pseudomera* sp., and *Parapilekia beattyana*, n. sp., are reported from near Beatty, Nevada. *Ectenonotus raymondi*, n. sp., is proposed for *E. westoni* Raymond (not Billings) 1920.

THE present paper represents the results of a study of Pliomeridae and Cybelidae that occur in Nevada in formations commonly assigned to or correlated with the Pogonip limestone. A preliminary report on some of the material was presented before the Cordilleran Section of the Paleontological Society in April, 1940 (Holliday, 1940).

Because of the world-wide distribution and short geologic range of the members of the families Pliomeridae and Cybelidae a study of the two groups is at present being made by Percy E. Raymond and the writer. Since it would appear that both families have a common ancestry in the Upper Cambrian, a revision of the two groups together seems desirable.

The writer is greatly indebted to the following men for their valuable help in preparing the present paper: Siemon Wm. Muller, Stanford University; Hubert G. Schenck, Stanford University; Harry E. Wheeler, University of Nevada; Percy E. Raymond, Harvard University.

STRATIGRAPHIC NOMENCLATURE

A Lapworthian classification of Ordovician strata is used in this paper, based on English usage, whereby the Tremadocian of England and the *Apatokephalus* zone of the Scandinavian countries are treated as Upper Cambrian. The Arenigian of England, probably corresponding to the upper Beekmantown of eastern North America, is Lower Ordovician.

COLLECTIONS

Shermantown region.—Trilobites were collected at two localities in the upper 1600 feet of the type Pogonip limestone. This upper unit, separable on lithologic grounds from the cherty limestone which is the underlying unit, cannot be considered older than the lower Middle Ordovician, that is no older than the "Chazy" or Stone's River. The fauna is of such a nature as to indicate that the upper part of the unit may be as young as the Black River or Trenton of eastern North America.

Pseudomera barrandei, collected at locality 11,[1] occurs in Billings' divisions L, M, N, P of Newfoundland (Lower Ordovician) and the Oil Creek formation of the Simpson group of Oklahoma. The same species probably occurs in the Stinchar limestone of the Glensaul District, Ireland.

Pseudomera? nevadensis, a specimen of which was collected at locality 12, just below the Eureka quartzite contact, is known outside of Nevada only in Oklahoma, where Raymond (1925) reports it from the lower Simpson.

Ike's canyon.—The collection from north of Manhattan, Nevada, (locality 1) kindly made available for study by the Mackay School of Mines, contains a fauna similar to that of the upper Pogonip limestone. The specimens were collected by Clinton and Train at the type locality of Bassler's Ordovician sponge fauna (Bassler, 1927, 1941) from beds provisionally correlated with the Zanzibar formation of Ferguson (1924, pp. 20–22). Besides topotypes of the sponges, the collection contains *Pseudomera barrandei* and *P.? nevadensis*.

Bassler (1941) says that "this part of the Pogonip limestone seems to be represented elsewhere in North America in the Table Head formation of Newfoundland—." How-

[1] The locality numbers refer to a detailed register at the end of this paper.

ever, it seems probable that the sponge fauna is younger than the Table Head formation.

Beatty Region.—Fossils collected in 1938 by Stanley Feitler from Bare Mountain, southeast of Beatty, Nevada (localities 2 and 3), were studied during the winter of 1939–40. Additional specimens were collected (localities 4, 5, 6, 6a) by the writer during the summer of 1940. Unfortunately the precise stratigraphic position of the specimens collected by Feitler is not clear. However, a reconnaissance of the section yielded similar fossils and shows the approximate stratigraphic position of the Feitler collections.

The section consists of 1760 feet of interbedded limestone, dolomite, and shale. The lower 200 feet, consisting of massive dolomite, is in fault contact with a Carboniferous conglomerate. Overlying the limestone and shale is a quartzite 220 feet thick.

The trilobites collected were:

Ectenonotus connemaricus (Reed)
Ectenonotus marginatus, n. sp.
Parapilekia beattyana, n. sp.
Pseudomera sp.
Niobe? feitleri, n. sp.

This fauna appears allied to the fauna above the *Apatokephalus* zone of the Scandinavian countries, hence of Arenigian (Lower Ordovician) age. Since *Ectenonotus connemaricus* was originally described from strata of Arenigian age in Ireland, the Arenigian correlation is confirmed.

Niobe? feitleri is much like *N. brevicauda* Poulsen (1937, pp. 56–57, Pl. 7, figs. 9–10, 13?) from the Lower Ordovician of Greenland. *Parapilekia beattyana* has affinities with *P. speciosa* (Dalman) which occurs in the *Apatokephalus* zone of Sweden. *Pseudomera* sp. is a primitive member of the genus closely related to *P. barrandei*.

This assemblage is equivalent to or slightly older than that containing *Pseudomera barrandei* in divisions L, M, N, and P of Billings in Newfoundland, as shown by the above analysis of the trilobite faunas and by the associated graptolite fauna as shown by Leith (1941). The Beatty fauna is probably Lower Arenigian, and the Newfoundland fauna may grade from Lower to Upper Arenigian. A similar fauna occurs in Ike's Canyon at a horizon lower than that containing Bassler's sponge fauna.

SYSTEMATIC DESCRIPTIONS

Order OPISTHOPARIA

Family ASAPHIDAE Emmrich.

Genus NIOBE Angelin, 1852

Niobe ANGELIN, *1852*, Palaeontologia Suecia, pp. 13–14.
Niobe, VOGDES, *1925*, San Diego Soc. Nat. History, Trans., vol. 4, pt. 2, p. 106.

EXPLANATION OF PLATE 73

All figures retouched.

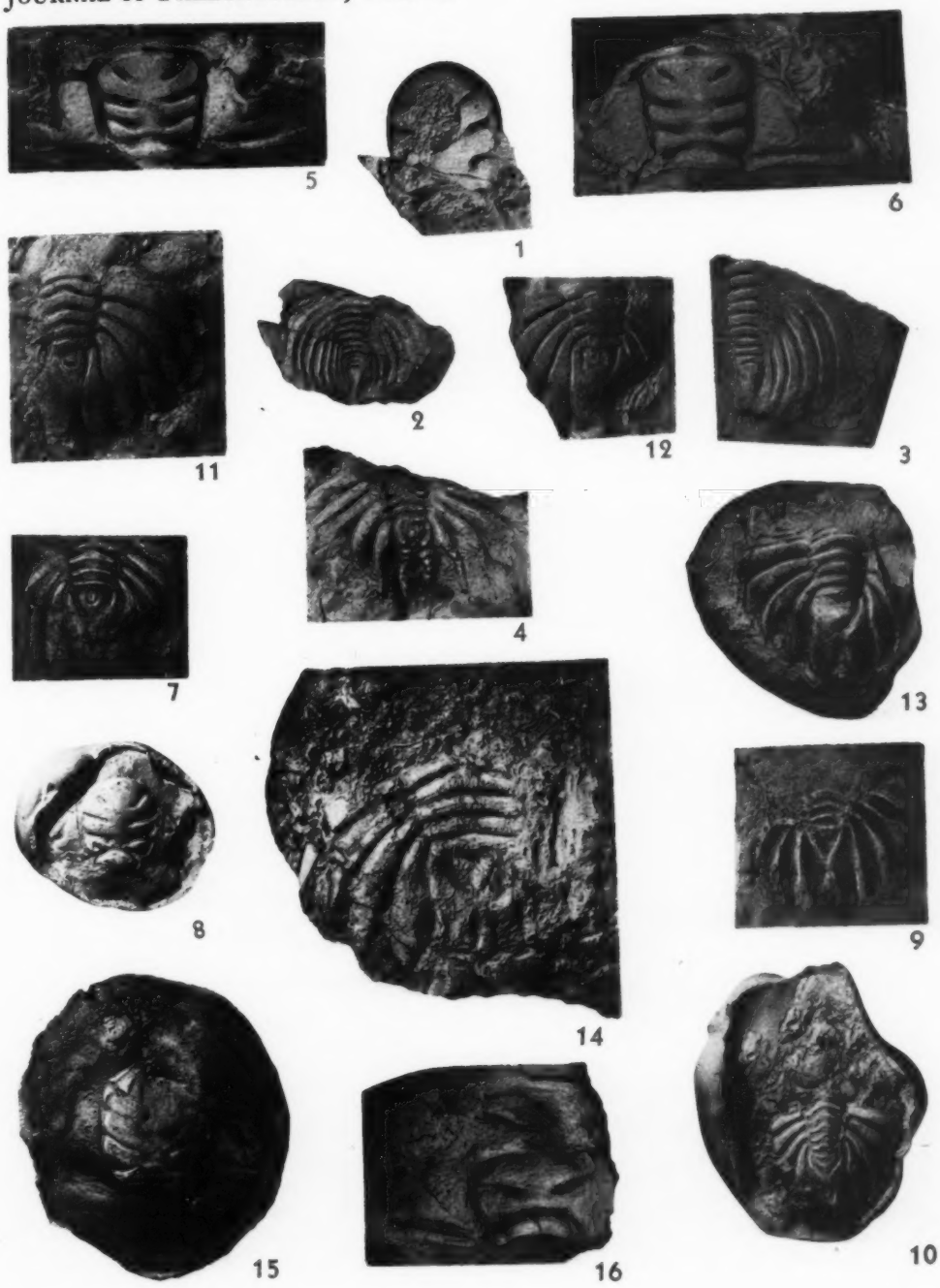
FIGS. *1, 2—Ectenonotus connemaricus* (Reed). *1*, Hypotype, glabella, loc. 2, Stanford Univ. Paleont. type coll. no. 6984 ×2; *2*, Hypotype, pygidium, loc. 2, Stanford University Paleont. type coll. no. 6985 ×2. (p. 476)

3—Ectenonotus marginatus Holliday, n. sp., Paratype, pygidium, loc. 2, Stanford Univ. Paleont. type coll. no. 6986 ×1. (p. 476)

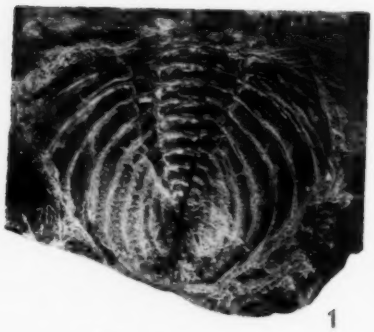
4—Parapilekia beattyana Holliday, n. sp. Paratype, pygidium, loc. 3, Stanford Univ. Paleont. type coll. no. 6987 ×1. (p. 475)

5–10—Pseudomera barrandei (Billings). *5*, Hypotype, cephalon, loc. 1, Univ. Nev. Mackay Museum Paleont. type coll. no. 15 ×1; *6*, Hypotype, cephalon, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 16 ×1; *7*, Hypotype, pygidium, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 19 ×1; *8*, Plastocotype, glabella, Canadian National Museum, no. 681b, Point Rich, Newfoundland, ×1. *9*, hypotype, natural external mold of pygidium, Stanford Univ. Paleont. type coll. no. 6988 ×1; *10*, Plastocotype, pygidium, Cow Head, Newfoundland, Canadian National Museum no. 682 ×1. (p. 474)

11–16—Pseudomera ? nevadensis (Walcott). *11*, Hypotype, pygidium, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 17 (same specimen as no. 4, *Lissacoelia ramosa* Bassler) ×1; *12*, Hypotype, pygidium, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 18 ×1; *13*, Hypotype, pygidium, loc. 1, Univ. Nev. Mackay Museum Paleont. type coll. no. 20 ×1; *14*, Hypotype, pygidium, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 21 ×1; *15*, Plastoholotype, glabella, Eureka District, U. S. Nat. Mus. no. 24645 ×1; *16*, Hypotype, glabella, loc. 1, Univ. Nev. Mackay Museum Paleont. coll. no. 22 ×1. (p. 474)



Holliday Ordovician Trilobites

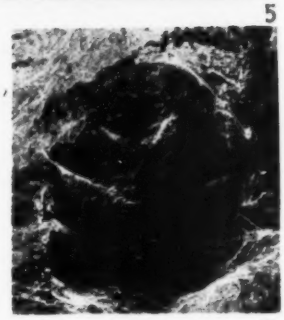


1

4

5

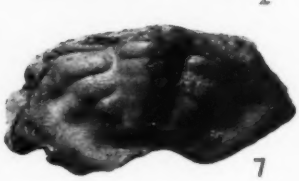
3



2

6

8



7

10

9

Holliday Ordovician Trilobites

Niobe, REED, *1930*, Ann. Mag. Nat. History, ser. 10, vol. 5, p. 299.

Genotype.—(By subsequent designation, Vogdes, 1925) *Niobe lata* Angelin (1852, p. 14, pl. 10).

Geologic range.—Upper Cambrian and Lower Ordovician, Europe, Asia, North America.

Remarks.—For further references on the genus *Niobe* see Reed (1930).

NIOBE? FEITLERI Holliday, n. sp.
Plate 74, figure 7

Remarks.—The only associated cephalon which might be assigned to the pygidium is a very poorly preserved fragment of a glabella with portions of the fixed cheeks attached. It has a broad frontal brim and three pairs of glabellar furrows which do not extend to the margins. Since the genus *Niobe* is based largely on the shape of the hypostoma this species can only questionably be assigned to the genus.

Holotype.—Harvard Coll., Mus. Comp. Zoology, no. 4719.

Type locality.—Beatty, Nevada, locality 6.

Pygidium semicircular with broad depressed brim. Axial lobe distinct, about one-fourth the width of the pygidium, ending at the concave brim. Two anterior axial furrows distinct, two posterior furrows indistinct. Three pairs of pleural ribs, crossed by a shallow furrow which sets off the brim.

Length of pygidium, 9.9 mm.; width, 19.1 mm.

Order PROPARIA
Family PLIOMERIDAE Öpik, 1937

Proparia with smooth or pitted cephalon, not strongly pustulose. Eyes small, unstalked. Glabella with parallel sides in the region posterior to the second glabellar furrow. Three pairs of lateral glabellar furrows. No longitudinal glabellar furrows.

Genus PSEUDOMERA Holliday, n. g.

Amphion (*partim*) of authors.
Pliomera (*partim*) of authors.
Pliomerops (*partim*) RAYMOND *1905*, Am. Jour. Sci., ser. 4, vol. 19, p. 378.

Genotype.—*Amphion barrandei* Billings 1865.

Geologic range.—Lower and Middle Ordovician, Europe and North America.

Diagnosis.—Pliomeridae with fixed cheeks essentially "L" shaped, nuchal furrow terminating before it reaches the genal angle. Median indentation in frontal glabelar lobe.

Remarks.—Since the nuchal furrow on the fixed cheek of *Pliomera* Angelin (1854, p. 30) does not extend around the genal angle as it does in *Pliomerops*, the two genera probably represent separate lines of evolution. *Pseudomera* is erected, with *Amphion barrandei* Billings as its type, to contain primitive members of the *Pliomera* group with only a rudimentary indentation in the frontal part of the cephalon and a nondenticulate frontal margin.

EXPLANATION OF PLATE 74

FIGS. *1, 2*—*Ectenonotus marginatus* Holliday n. sp. *1*, Holotype, pygidium, loc. 6a, Harvard Coll. Mus. Comp. Zoology no. 4715 ×1 (retouched); *2*, Paratype, glabella, loc. 6, Harvard Coll. Mus. Comp. Zoology no. 4717 ×2. (p. 476)

3—*Parapilekia beattyana* Holliday n. sp. Holotype, cephalon, loc. 6, Harvard Coll. Mus. Comp. Zoology no. 4718 ×1. (p. 475)

4—*Ectenonotus raymondi* Holliday n. sp. Holotype, pygidium and fragmental thorax, Point Rich Beds, Newfoundland, Peabody Mus. Nat. Hist., New Haven, Conn., no. 11314 ×1. (p. 476)

5—*Pseudomera* sp. Cephalon, loc. 5, Harvard Coll. Mus. Comp. Zoology no. 4713 ×1 (p. 475)

6—*Pseudomera ? nevadensis* (Walcott). Hypotype, glabella, loc. 12, Harvard Coll. Mus. Comp. Zoology no. 4720. ×1. (p. 474)

7—*Niobe ? feitleri* Holliday n. sp. Holotype, pygidium, loc. 6, Harvard Coll. Mus. Comp. Zoology no. 4719 (artificial cast) ×1.5. (p. 473)

8–10—*Ectenonotus connemaricus* (Reed). *8*, Artificial cast of specimen in fig. 9; *9*, Hypotype, natural external mold of pygidium, loc. 6, Harvard. Coll. Mus. Comp. Zoology no. 4714 ×2; *10*, Hypotype, pygidium, loc. 6a, Harvard Coll. Mus. Comp. Zoology no. 4716 ×2. (p. 476)

PSEUDOMERA BARRANDEI (Billings)
Plate 73, figures 5–10

Amphion barrandei BILLINGS *1865*, Canada Geol. Survey, Palaeozoic Fossils, vol. 1, pp. 288–289, fig. 277, a-b.
Pliomerops barrandei, RAYMOND, *1905*, Am. Jour. Sci., ser. 4, vol. 19, p. 378. Idem. *1910*, Ann. Carnegie Mus., vol. 7, no. 1, p. 76, fig. 7. Idem (*part*) *1925*, Harvard Coll. Mus. Comp. Zoology, Bull. 67, no. 1, p. 153.
Pliomerops barrandei, PHLEGER, *1933*, Southern Calif. Acad. Sci. Bull. 32, pt. 1, pp. 1–21, pl. 2, figs. 10–11.
?Pliomera aff. *barrandei*, REED, *1909*, Geol. Soc. London Quart. Jour., vol. 65, pp. 145–146, pl. 6, fig. 5.
Pliomera aff. *barrandei*, Raymond, *1925*, Harvard Coll. Mus. Comp. Zoology, Bull. 67, no. 1, p. 155.
?Pliomerops cf. *barrandei*, REED, *1910*, Geol. Soc. London Quart. Jour., vol. 66, p. 261.

Anterior glabellar furrows lightly impressed, not extending to the margin of the glabella. Genal angles rounded, not prolonged into spines. Pygidium with pleural ribs relatively thin, more widely separated than in *Pliomera* or *Pliomerops*, less widely separated than in *Pilekia* or *Parapilekia*, not joined in any part. Lunate groove in the anterior half of the postaxial boss of the pygidium.

Length of cephalon, 10.0 mm.; width, 52.7 mm.; width of glabella at anterior end, 12.3 mm.; thickness of cephalon (end of fixed cheek to top of glabella), 10.0 mm.; length of axis of the pygidium without terminal boss, 17.6 mm.; length of terminal boss, 3.0 mm.

Remarks.—From comparison of the plasto-syntypes of *Pseudomera barrandei*, made available by the Canadian Geological Survey, with the plasto-holotype of *P.? nevadensis*, made available by the U. S. National Museum, it is obvious that Phleger (1933) was mistaken in stating that the two species are the same. The main difference is that the sides of the glabella of *P.? nevadensis* are parallel, while the glabella of *P. barrandei* expands forward.

Pliomerops barrandei of Raymond from the Simpson of Oklahoma differs from the type specimens in that the sides of the glabella in the Oklahoma trilobite contract forward, while those of *Pseudomera barrandei* expand forward. The Oklahoma form may represent a variant of *P. barrandei* transitional to *P.? nevadensis*. However, there does not seem to be sufficient justification for erecting a new species at the present time.

Pliomera aff. *barrandei* of Reed (1909), called *Pliomerops* sp. by Raymond (1925), is questionably referred to *Pseudomera barrandei*. It has affinities with *Pilekia* and *Parapilekia*. Since *Pliomerops* cf. *barrandei* of Reed (1910) was not figured, it can only questionably be assigned to the species.

Syntypes.—The syntypes upon which this species presumably was based are Canadian Nat. Mus. nos. 681b and 682 (pl. 73, figs. 8 and 10 of this report). The type locality is presumably Cow Head, Newfoundland. Since it is not certain that these are the specimens figured by Billings (figs. 277, a, b) the identity of the primary types will have to be left in abeyance for the present.

Hypotypes.—Univ. of Nev., Mackay Museum Paleont. Coll., nos. 15, 16, 19; Stanford University Paleont. Type Coll. no. 6988.

Nevada localities.—Middle Ordovician, Zanzibar? formation, Ike's Canyon, Nevada, locality 1; Upper Pogonip, White Pine District, Nevada, locality 11.

PSEUDOMERA? NEVADENSIS (Walcott)
Plate 73, figures 11–16; Plate 74, figure 6

Amphion nevadensis WALCOTT *1884*, U. S. Geol. Survey, Mon. 8, p. 94, pl. 12, fig. 13.
Pliomerops? nevadensis, BASSLER, *1915*, U. S. Nat. Mus. Bull. 92, vol. 2, p. 1016.
Pliomerops nevadensis, RAYMOND, *1925*, Harvard Coll. Mus. Comp. Zoology Bull. 67, no. 1, pp. 157–158, pl. 10, fig. 15. (not) PHLEGER, *1933*, Southern Calif. Acad. Sci. Bull. 32, pt. 1, pp. 1–21, pl. 2, figs. 10–11. (=*P. barrandei*)

Sides of glabella parallel, anterior margin of frontal glabellar lobes essentially at right angles to sides, anterior furrows cutting corners of glabella. Glabella about same width as length.

Pygidium as in *P. barrandei*, but in *P.? nevadensis* the pleural ribs are relatively thicker and the posterior pair relatively shorter. The lunate furrow in the post-axial boss identical with that in *P. barrandei*.

Length of glabella, 19.2 mm.; inferred width, 20.8 mm.; length of pygidium, 20.6 mm.; total width, 29.6 mm.; length of post-axial boss, 3.0 mm.

Remarks.—*Pseudomera? nevadensis* and *P. barrandei* appear to be closely related. Their stratigraphic ranges are nearly the

same, although *P.? nevadensis* may exist in strata younger than those containing *P. barrandei*. It is upon the general similarity of the two species that questionable assignment of *P.? nevadensis* to the genus *Pseudomera* is based. However, until the character of the nuchal furrow of *P.? nevadensis* is known the generic assignment cannot be made definitely.

Holotype.—U. S. Nat. Mus. no. 24645.

Hypotypes.—Univ. of Nev. Mackay Museum Paleont. coll. nos. 17, 18, 20–22. Harvard Coll. Mus. Comp. Zoology no. 4720.

Type locality.—Ordovician; Upper Pogonip, Bellevue Peak, Eureka District, Nevada.

PSEUDOMERA sp.
Plate 74, figure 5

One specimen from locality 5, Beatty, Nevada, a fragmental cephalon, is clearly a member of the genus *Pseudomera*, as shown by the shape of the fixed cheek, and the discontinuity of the nuchal furrow. The anterior position of the eye (opposite the first glabellar furrow) suggests that it is not a primitive member of the genus.

Width of glabella at posterior end, 10.1 mm.; length of fixed cheek, 15.0 mm.; thickness of cephalon (top of glabella to end of fixed cheek) 4.5mm.

Genus PARAPILEKIA Kobayashi, 1934, emend. Holliday

Parapilekia KOBAYASHI *1934*, Tokyo Imp. Univ., Jour. Fac. Sci., sec. 2, jour. 3, pt. 2, p. 570.

Genotype.—(By designation in this report) *Calymene? speciosa* Dalman, 1827 (p. 260).

Geologic Range.—Upper Cambrian and Lower Ordovician Europe; Lower Ordovician, North America.

Pliomeridae with glabella elongate. Glabellar furrows extending less than one-third the width of the glabella, directed slightly posteriorly at their inner terminations.

Pygidium with spinose ribs widely separated, joined on the inner portion, but distally free. The post-axial boss may include one rudimentary axial ring, as in *P. speciosa*, or several, as in *P. julia* (*Amphion julius* Billings 1865, p. 290, fig. 279).

Remarks.—The genus *Parapilekia* as proposed by Kobayashi is invalid under the International Rules of Zoological Nomenclature inasmuch as it was proposed without a designated genotype, two species being listed (Article 25, a) (3). The generic name is now proposed with Kobayashi's first species, *Calymene? speciosa* Dalman as genotype.

PARAPILEKIA BEATTYANA Holliday, n. sp.
Plate 73, figure 4; plate 74, figure 3

Eyes located about opposite the second glabellar furrows. Posterolateral extension of fixed cheeks shorter than the length of the glabella. Fourth pair of glabellar furrows probably absent.

Pygidium with five pairs of ribs joined only at their innermost portions. Posterior pair of ribs parallel the axis, completely enclosing the postaxial boss. Boss probably composed of one unit. A sixth pair of pleural ribs doubtfully present.

Length of cephalon (holotype), 16.3 mm.; width, 36.0 mm.; length of fixed cheek (posterolateral extension), 13.5 mm.; width of glabella, 12.5 mm.; length of pygidium (paratype), 21.2 mm.; length of postaxial boss, 3.0 mm.; width of axis, 6.4 mm.; total width of pygidium, 31.8 mm.

Remarks.—This species differs from *Parapilekia speciosa* in the posterior position of the eyes, and the shape of the fixed cheeks. The pygidium is suggestive of the Middle Ordovician genus *Pilekia* (Barton, 1916, p. 113).

Holotype.—Harvard Coll. Mus. Comp. Zoology no. 4718.

Paratype.—Stanford University Paleont. type coll. no. 6987.

Type locality.—Lower Ordovician, Beatty, Nevada, locality 6. Paratype from locality 2.

Family CYBELIDAE Holliday, new name

The new name Cybelidae is proposed for the family of proparian trilobites formerly known as Encrinuridae. The removal of the genus *Encrinurus* from the family (Whittard, 1938) makes necessary the change of name.

Genus ECTENONOTUS Raymond, Pizo

Ectenonotus RAYMOND *1920*, Harvard Coll. Mus. Comp. Zoology Bull. 64, no. 2, pp. 295–296.
Ectenonotus RAYMOND, 1925, vol. 67, no. 1, p. 137.

Ectenonotus, REED, *1928*, Geol. Mag., vol. 65, p. 68.

Genotype.—Amphion westoni Billings (by original designation).

Geologic Range.—Lower Ordovician, Europe and North America.

Surface smooth, not pustulose. Frontal glabellar lobe convex forward, frontal glabellar furrows lightly impressed. Pygidium "*Ecrinurus*"-like, consisting of an axial lobe with the number of axial segments greater than the number of pleural segments. Pleural ribs terminating at margin of pygidium or against the postaxial boss. Axis keellike, raised, terminating in median postaxial boss. Variable number of juvenile axial and pleural segments more or less coalesced with the boss.

ECTENONOTUS CONNEMARICUS (Reed)
Plate 73, figures 1–2; plate 74, figures 8–10

Cybele connemarica REED *1909*, Geol. Soc. London Quart. Jour., vol. 65, pp. 146–147, pl. 6, figs. 6–7.

Cybele connemarica, VOGDES, *1925*, San Diego Soc. Nat. History Trans., vol. 4, pt. 3, p. 132.

Pygidium consisting of 11 axial rings, 9 to 10 pleural ribs, and a median postaxial boss. The posterior three ribs do not reach the margin but end against the postaxial boss.

Plate 73, figure 2 shows a growth stage in which two axial rings and two corresponding pairs of pleural ribs are just emerging from the post-axial segment.

Measurements of a hypotype: width of glabella at posterior end, 11.7 mm.; length of glabella, 12.0 mm.; width of pygidium, 16.0 mm.; length, 16.7 mm.; length of boss, 2.9 mm.

Remarks.—According to Reed's description of the species, the posterior five pleural ribs do not extend to the margin of the pygidium, but terminate against the postaxial boss. The Nevada trilobite shows only the posterior three pairs of pleural ribs terminating against the boss. However, it appears from Reed's figure that his description may be inaccurate, as only three pairs of ribs are shown to end in the boss.

Hypotypes.—Stanford Univ. Paleont. type coll. nos. 6984, 6985. Harvard Coll. Mus. Compar. Zoology nos. 4714, 4716.

Type locality.—Upper Arenigian, Gortbunacullin, Smithy Bridge, Ireland.

Nevada localities.—Lower Ordovician, Beatty, localities 2, 6, 6a.

ECTENONOTUS RAYMONDI Holliday, n. sp.
Plate 74, figure 4

Ectononotus westoni RAYMOND *1920* (Not Billings, 1865), Harvard Coll. Mus. Comp. Zoology, Bull. 64, no. 2, p. 295.

Ectenonotus westoni, RAYMOND, 1925, idem, Bull. 67, no. 1, p. 137.

Pygidium with 22 axial and 10 pleural segments. The posterior six axial rings join to form the homologue of the terminal boss of other species of *Ectenonotus*. The next nine rings are joined to three pleural ribs, three rings to each rib.

Length of thorax (12 segments), 20.2 mm.; inferred greatest width of thorax, 18.0, mm.; length of pygidium, 13.9 mm.; width 10.0 mm.

Remarks.—The determination of this species is based upon the holotype, kindly made available for study by Dr. C. O. Dunbar of the Peabody Museum. The holotype is the specimen studied and described by Raymond (1920 and 1925).

No cephalon of the species is known. The species is distinguished from *E. westoni* by the difference in number and arrangement of axial and pleural segments. *E. westoni* has 17 axial segments and a segmented postaxial boss, with only eight pairs of pleural ribs.

E. raymondi and *E. westoni* resemble *E. contentus* (*Encrinurus contentus* Reed 1931, p. 39, Pl. 6, figs. 11, 12), and together with the latter species form a group which may be related to the ancestor of *Cybele*.

Holotype.—Peabody Museum of Natural History, New Haven, no. 11314.

Paratype.—Peabody Museum of Natural History, New Haven, no. 11315.

Type locality.—Lower Ordovician, Point Rich beds, Newfoundland.

ECTENONOTUS MARGINATUS Holliday, n. sp.
Plate 73, figure 3; plate 74, figures 1, 2

An *Ectenonotus* allied to *E. connemaricus*. Terminations of pleural ribs coalesced to form entire margin. One juvenile ring and a pair of pleural ribs in state of emergence from the post-axial boss.

Width of pygidium, 42.0 mm.; length 33.0 mm.; length of glabella, 15.5 mm.; width, 13.5 mm.

Holotype.— Harvard Coll. Mus. Comp. Zoology no. 4715.

Paratypes.—Stanford Univ. Paleont. type coll. no. 6987.

Type locality.—Lower Ordovician, Beatty, Nevada, locality 6a.

REGISTER OF LOCALITIES

The localities given in the text correspond to private locality numbers. The equivalents in other locality books are abbreviated as follows: L.S.J.U., Leland Stanford Junior University fossil locality; U.N., University of Nevada, Mackay Museum fossil locality.

1.—Nye County, Nevada, east side of Toquima Range, about 4 miles west of Diana's Punch Bowl, one half mile south of Ike's Canyon. Collected by H. G. Clinton and Percy Train, about 1926. (U.N. 24)

2.—Nye County, Nevada, Furnace Creek Quadrangle. About 1 mile south-east of Beatty, in a steep gully in Meikeljohn Peak on the road leading up Telluride Canyon and just north of the summit above the south pass to Crater Flat. The locality is just below a cliff forming limestone (dolomite) on the left (north) of the road. Collected by Stanley Feitler, December, 1938. (L.S.J.U. 2204)

3.—The same as locality 2, but about 400 feet stratigraphically higher, above the cliff-forming limestone (dolomite). Collected by Stanley Feitler, December, 1938. (L.S.J.U. 2205)

4.—The same as locality 3. Taking the prominent cliff of dolomite nearest the road, and nearest the summit over which the road leads to Speece's Spring, from the point of the cliff, 150 feet N 38° E, 350 feet in elevation above the road, in thin bedded limestone and shale. Collected by S. Holliday, June 19, 1940.

5.—240 feet N 40° E of locality 4 and 220 feet stratigraphically higher. Collected by S. Holliday, June 19, 1940.

6.—From locality 4, N 45° E 760 feet. 660 feet stratigraphically higher. Collected by S. Holliday, June 19, 1940.

6a.—35 feet stratigraphically below locality 6.

11.—White Pine County, Nevada, White Pine District, NW ¼, SW¼, NW¼, section 45, T. 16 N., R. 57 E., Mt. Diablo Meridian, 1925 feet above Shermantown. In saddle of Pogonip Ridge, cherty shaly member of upper Pogonip limestone. Collected by S. Holliday, August, 1939. (L.S.J.U. 2182).

12.—From 11, 2600 feet S 18° W, elevation 1800 feet above Shermantown. Blue-grey limestone, weathering buff, upper Pogonip limestone. Directly underlying the Eureka quartzite. Collected by S. Holliday, August, 1940.

REFERENCES

ANGELIN, N. P., *1852, Palaeontologia Sueciea*, pp. 1–24, pls. 1–24.

——, *1854, Palaeontologia Scandinavica*, pp. 21–92, pls. 25–41.

BARTON, DONALD C., *1916*, A Revision of the Cheirurinae with Notes on their Evolution: *Washington Univ. Studies*, vol. 3, pt. 1, no. 1, (July, 1915), pp. 101–152, figs. 1–25, 1 table.

BASSLER, R. S., *1915*, Bibliographic Index of American Ordovician and Silurian Fossils: *U. S. Nat. Mus. Bull.* 92, pts. 1 and 2, pp. i–viii, 1–1521, pls. 1–4, correlation table.

——, *1927*, A new early Ordovician sponge fauna: *Washington Acad. Sci. Jour.* 17, no. 15, pp. 391–394.

——, *1941*, The Nevada Early Ordovician sponge fauna: *U. S. Nat. Mus. Proc.*, vol. 91, no. 3126, pp. 91–102, pls. 19–24.

BILLINGS, E., *1865*, Paleozoic Fossils: *Canada Geol. Survey*, vol. 1, pp. 153–426, figs. 153–399.

DALMAN, J. W., *1826*, Om palaederna elier de så Kallade Trilobiterna: *Svenska K. Vetensk. Akad. Handl.*, pp. 226–294, pls. 1–6.

FERGUSON, H. G., *1924*, Geology and Ore Deposits of the Manhattan District, Nevada: *U. S. Geol. Survey Bull.* 723, pp. 1–163, figs. 1–15, pls. 1–18.

HOLLIDAY, S., *1940*, Ordovician Trilobites of Nevada (abstract): *Geol. Soc. Amer., Bull.* 51, no. 12, pt. 2, p. 1984.

LEITH, E., *1941*, Unpublished paper, presented Dec. 30, 1941 before the Paleontological Society, Boston.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE, *1922*, *Smithsonian Misc. Coll.*, vol. 73, no. 1, publ. 2657, pp. 1–73.

KOBAYASHI, T., *1934*, The Cambro-Ordovician Formations and Faunas of South Chosen, pt. 2, Lower Ordovician Faunas: *Tokyo Imp. Univ. Jour. Fac. Sci.*, sect. 2, vol. 3, pt. 9, pp. 522–585, pls. 1–8.

ÖPIK, A., *1937*, Trilobiten aus Estland: *Univ. Tartu. Geol. Inst. Pub.* no. 52, pp. 1–163, figs. 1–42, pls. 1–26.

PHLEGER, F. B. JR., *1933*, Notes on Certain Ordovician Faunas of the Inyo Mountains, California: *Southern California Acad. Sci., Bull.* 32, pt. 1, pp. 1–6, pls. 1–2.

POULSEN, C., *1937*, On the Lower Ordovician Faunas of East Greenland: *Meddelelser om Grønland*, vol. 119, no. 3, pp. 1–72, figs. 1–18, pls. 1–8.

RAYMOND, P. E., *1905*, Notes on the Names *Amphion*, *Harpina*, and *Platymetopus: Am. Jour. Sci.*, vol. 19, no. 3, pp. 377–378.

——, *1910*, Notes on Ordovician Trilobites, Part 4, New and Old Species from the Chazy: *Carnegie Museum Ann.*, vol. 7, no. 1, pp. 60–80, pls. 17–19, figs. 1–9.

——, *1920*, Some New Ordovician Trilobites: *Harvard Coll. Mus. Comp. Zoölogy, Bull.* 64, no. 2, pp. 273–296.

——, *1925*, Some Trilobites from the Lower Middle Ordovician of Eastern North America: *Harvard Coll. Mus. Comp. Zoölogy Bull.* 67, no. 1, pp. 3–180, pls. 1–10.

REED, F. R. C., *1909*, (in Gardiner) The Rocks of the Tourmakeady District, Palaeontologic Appendix: *Geol. Soc. London Quart. Jour.*, vol.

65, pp. 151–152, figs. 1–9, pl. 6.

——, *1910*, (in Gardiner and Reynolds) The Ordovician of the Glensaul District: *Geol. Soc. London Quart. Jour.*, vol. 66, pp. 271–278, pls. 20–22.

——, *1928*, Notes on the Family Encrinuridae: *Geol. Mag.*, vol. 65, pp. 51–77.

——, *1930*, A Review of the Asaphidae: *Ann. Mag. Nat. History*, ser. 10, vol. 5, pp. 288–320.

——, *1931*, Additional new Trilobites from Girvan: *Ann. Mag. Nat. Hist.*, ser. 10, vol. 7, pp. 97–105, pls. 4–5.

VOGDES, A. W., *1925*, A Summary of the Ordovician genus *Cybele* Lovén: *San Diego Soc. Nat. Hist., Trans.*, vol. 4, pt. 3, pp. 117–154, pls. 1–2.

WALCOTT, C. D., *1884*, Paleontology of the Eureka District: *U. S. Geol. Survey Mon.* 8, pp. 1–298, pls. 1–24.

WHITTARD, W. F., *1938*, The Upper Valentian Trilobite Fauna of Shropshire: *Ann. Mag. Nat. History*, ser. 11, vol. 1, pp. 85–140, pls. 2–5.

MANUSCRIPT RECEIVED BY THE EDITOR APRIL, 17, 1941.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 479–481, 2 TEXT FIGS., JULY 1942

A GONIATITE FROM THE MISSISSIPPIAN FERN GLEN FORMATION OF ILLINOIS

A. K. MILLER AND COURTNEY WERNER
State University of Iowa, Iowa City, Iowa
and
Washington University, St. Louis, Missouri

ABSTRACT—In this paper the generic names *Aganides*, *Brancoceras*, and *Imitoceras* are discussed; and a new species, *Imitoceras pfefferae*, is established for a unique specimen from the Fern Glen limestone near Valmeyer, Illinois.

THE PORTION of the American Mississippian system that is known as the Osage group has yielded only a very few goniatites. All of these came from the Burlington limestone of Missouri, the approximately equivalent New Providence shale of Kentucky and Indiana, and possibly the Price formation of Virginia; and the only genus that has been identified definitely from this group is *Münsteroceras*. Therefore the discovery of a unique specimen in the Fern Glen limestone, which immediately underlies the Burlington, seems worth recording, particularly since it represents a genus not previously recognized in the Osage, though one that is fairly abundant in the underlying Kinderhook.

There is, however, some question as to what generic term should be employed for this Fern Glen specimen. The group to which it belongs has within fairly recent times been referred to *Aganides* de Montfort 1808, *Brancoceras* Hyatt, 1884, and *Imitoceras* Schindewolf 1923. The second of these, *Brancoceras* Hyatt 1884, is to be suppressed as a homonym of *Brancoceras* Steinmann 1881, a Cretaceous ammonite genus.

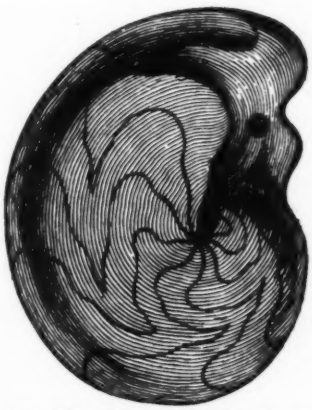


FIG. 1.—De Montfort's original illustration of the genoholotype of *Aganides*, "Le nautile encapuchonné," ×1.

When de Montfort established *Aganides* in 1808 (pp. 30–32) he stated definitely that the species which should be regarded as the genotype is the one that he had illustrated and described in 1804 (Pl. 48, fig. 1, and pp. 253–254) as "Le nautile encapuchonné." This original diagnosis of *Aganides* is accompanied by a poorly executed copy of the illustration published in 1804 and reproduced as text figure 1 of the present report. This figure is stated by de Montfort to represent a specimen from dark fetid limestone in the vicinity of Namur, Belgium. Some authors, like Fischer, have concluded that de Montfort's figure, which has all of the aspects of being woefully inaccurate, represents the lower Carboniferous form later described by de Koninck as *Ammonites rotatorius;* but others have thought that it represents a nautiloid of the type of *Aturia*. However, it seems to us that, as de Koninck (1880, p. 87) believed, the specimen studied by de Montfort was probably a Middle Carboniferous goniatite of the type of *Goniatites striatus* (Sowerby), and this conclusion is supported by the nature and the location of the rocks in which it was found. Since almost certainly the identity of the specimen on which de Montfort's description and illustration are based can never be determined, and since the species represented by that specimen must be retained as the genotype of *Aganides*, that generic name, though entirely valid, is quite useless, for no forms can be referred to it with a reasonable degree of certainty. Somewhat the same conclusion was reached by Schindewolf in 1923 (pp. 325–329), and he then proposed the generic

name *Imitoceras* for the goniatites that had come to be referred to *Aganides* and later designated *Ammonites rotatorius* de Koninck as genotype.

Imitoceras is at least superficially similar to *Gattendorfia* Shindewolf, 1920, and *Prionoceras*, Hyatt, 1884 [= *Postprolobites* Wedekind 1913]. However, Schindewolf places these two latter genera in the family Prolobitidae Wedekind, 1913, whereas he refers *Imitoceras* to the Cheiloceratidae Frech, 1897, a procedure that has recently been questioned by Librovitch (1940, p. 227). These two families are stated to differ in the nature of the growth lines and constrictions and in the development of certain elements of the sutures, which can not be studied satisfactorily in the specimen under consideration.

IMITOCERAS PFEFFERAE Miller and Werner, n. sp.
Text figures 2A–C

The holotype of this species is a moder-

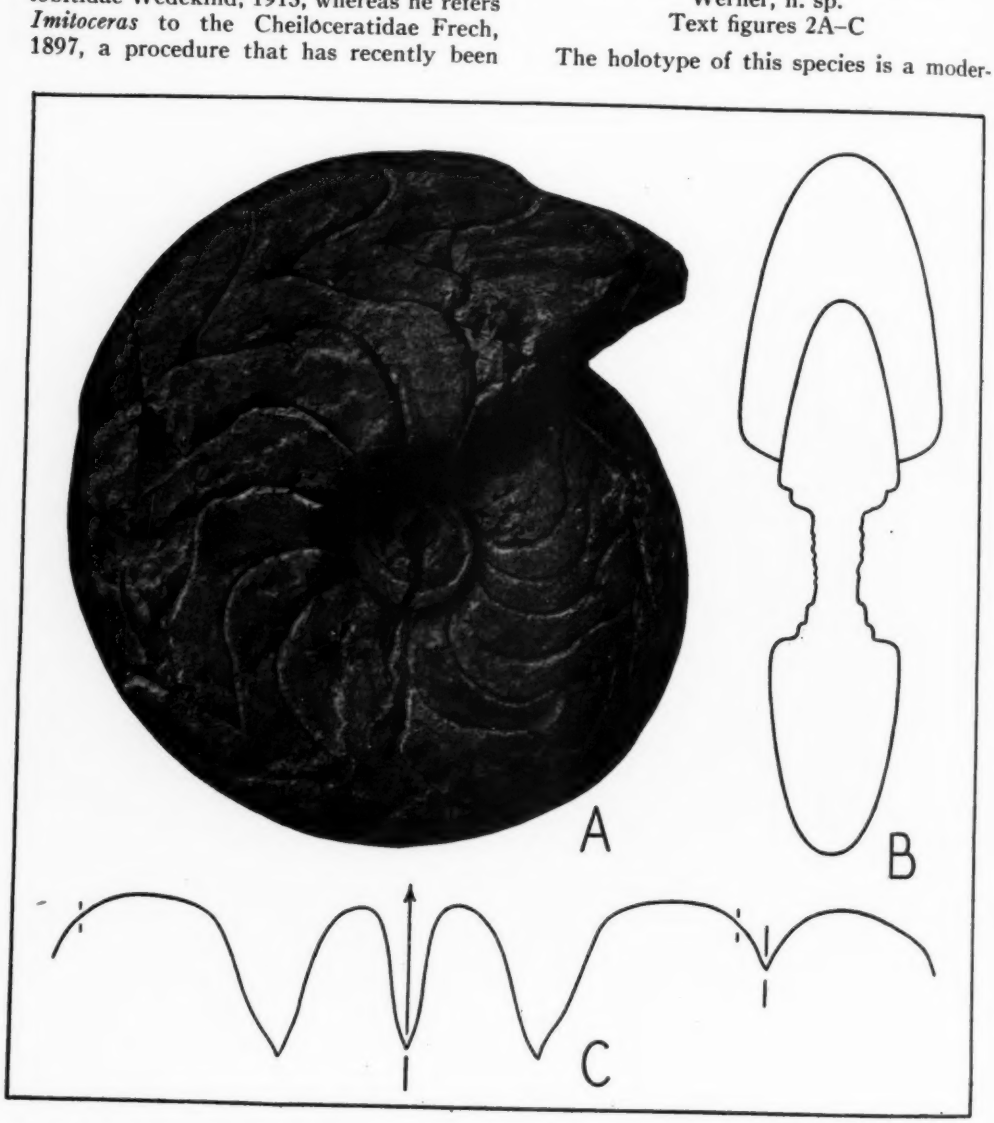


FIG. 2.—*Imitoceras pfefferae* Miller and Werner, n. sp., from the Fern Glen limestone east of Valmeyer, Illinois, ×1.

ately well preserved internal mold that is septate throughout. The conch is fairly large and is sublenticular in shape as the whorls are compressed, the lateral zones are flattened and coverged ventrally, the ventral zone is narrowly rounded, and the dorsal zone is deeply impressed—the depth of the impressed zone is equal to about half the height of the whorl. The preserved portion of the holotype attains a maximum diameter of about 100 mm., and a maximum height of conch of about 45 mm.; the corresponding width can not be determined accurately as the specimen is somewhat crushed laterally, but it is of the order of 30 mm. The umbilicus is not closed and that of the holotype attains a diameter of about 24 mm. The umbilical shoulders are abruptly rounded and the umbilical walls are steep. Traces of what may be sinuous transverse constrictions are present on the outer volution of the holotype.

At maturity each suture forms a deep narrow V-shaped ventral lobe and on either side of it a slightly asymmetrical U-shaped first lateral saddle, a V-shaped first lateral lobe (which is slightly deeper than the ventral lobe), a low broad asymmetrical second lateral saddle, a shallow V-shaped lobe on the umbilical seam, and a rounded asymmetrical internal second lateral saddle. The precise nature of the internal lobes can not be ascertained, but there is nothing to indicate that they are different from those of other representatives of this genus.

Remarks.—The discoverer of this unique specimen, Miss Madeline Pfeffer, presented it to Washington University. Dr. Wm. H. Easton of the Illinois Geological Survey furnished us with data in regard to its occurrence. The matrix, as well as the specimen, consists of red argillaceous limestone, which is very fossiliferous. Unfortunately, the inner volutions of the conch are not visible and are probably not preserved.

All of the congeneric species that have been described from America have umbilici that are closed (or essentially so). However, the paleontological collections of the University of Missouri contain a unique specimen from the Lower Mississippian Chouteau limestone of central Missouri in which the umbilicus is only slightly smaller than that of the Fern Glen form under consideration. Also, the Lower Carboniferous of Europe has yielded a species, *I. apertum* Schindewolf, in which the umbilicus is of the same general size and shape as that of *I. pfefferae.*

Occurrence.—The only known representative of this species was found by Miss Magdalen Pfeffer during the summer of 1941 near the base of the Fern Glen limestone in a road-cut in Dennis Hollow, about 1 mile east of Valmeyer, Monroe County, Illinois; that is, in the SE corner sec. 3, T. 3 S., R. 11 W. At this locality the Fern Glen consists of reddish argillaceous limestone interbedded with reddish shale.

Repository.—Washington University, St. Louis, Missouri.

REFERENCES

DE KONINCK, L.-G., *1880*, Faune du Calcaire Carbonifère de la Belgique, deuxième partie, Genres: Gyroceras, Cyrtoceras, Gomphoceras, Orthoceras, Subclymenia et Goniatites: *Mus. Royal Hist. Nat. Belgique Ann.*, sér. Pal., tome 5, pp. 1–133, pls. 32–50 (in an atlas).

LIBROVITCH, L. S., *1940*, Carboniferous ammonoids of North Kazakhstan: *USSR Acad. Sci., Pal. Inst., Pal. USSR*, vol. 4, pt. 9, fasc. 1, pp. 1–394, pls. 1–25.

MONTFORT, PIERRE DENYS DE, *1804*, *Histoire naturelle, générale et particulière des Mollusques*, Animaux sans vertèbres et a sang blanc; Ouvrage faisant suite à l'Histoire Naturelle générale et particulière, composée par Leclerc de Buffon et rédigée par C. S. Sonnini . . . , tome 4, pp. 1–376, pls. 1–50.

——, *1808*, *Conchyliologie systématique, et classification méthodique des coquilles* . . . , tome 1, pp. 1–409.

SCHINDEWOLF, O. H., *1923*, Beiträge zur Kenntnis Paläozoicums in Oberfranken, Ostthüringen und dem Sächsischen Vogtlande: *Neues Jahrb. für Min., Geol. und Pal., Beilage-Band* 49, pp. 250–357, 393–509, pls. 14–18.

——, *1926*, Beiträge zur Kenntnis der Cephalopodenfauna des oberfränkisch-ostthüringischen Unterkarbons: *Senckenbergiana*, Bd. 8, pp. 63–96.

WEDEKIND, RUDOLF, *1918*, Die Genera der Palaeoammonoidea (Goniatiten), (Mit Ausschluss der *Mimoceratidae, Glyphioceratidae* und *Prolecanitidae*): *Palaeontographica*, Bd. 62, pp. 85–184, pls. 14–22.

MANUSCRIPT RECEIVED BY THE EDITOR FEBRUARY 4, 1942

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 482–483, 3 TEXT FIGS., JULY 1942

A NEW OSTRACODE FROM THE CLAIBORNE EOCENE OF TEXAS[1]

MORTON B. STEPHENSON
Stanolind Oil and Gas Company, Houston, Texas

ABSTRACT—*Cytheridea* (*Haplocytheridea*) *stenzeli*, a new ostracode from the Reklaw formation, Claiborne Eocene of Texas, is described and figured.

DURING A study of the ostracode genus *Cytheridea* in the Gulf Coast Tertiary, a new and interesting species has been discovered. My specimens came from the Reklaw formation, lower Claiborne Eocene, at an exposure near the town of Smithville, Bastrop County, Texas. The species is one of the more distinctive forms in the Reklaw microfauna.

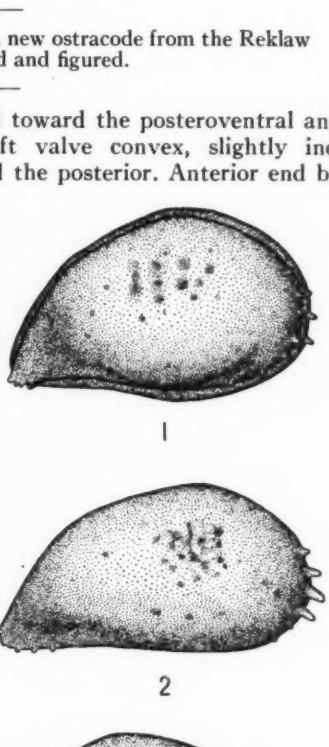
The new species, *Cytheridea* (*Haplocytheridea*) *stenzeli*, is described from material collected by J. B. Garrett and C. F. Washburn, of Stanolind Oil and Gas Company, Houston, Texas. My thanks are extended to them for providing the sample used in this study. The location of the outcrop was obtained from Doctor H. B. Stenzel, Bureau of Economic Geology, Austin, Texas, to whom I am also indebted.

Type specimens of the new species have been deposited in the Louisiana State University Museum, University, Louisiana.

SYSTEMATIC DESCRIPTIONS

Family CYTHERIDAE Baird, 1850
Genus CYTHERIDEA Bosquet, 1852
Subgenus HAPLOCYTHERIDEA Stephenson, 1936
CYTHERIDEA (HAPLOCYTHERIDEA) STENZELI Stephenson, n. sp.
Text figures 1–3

Carapace tumid; in side view subpyriform, highest at about the anterior one-third the shell length, thickest somewhat posterior to the middle. Left valve larger than the right, overlapping around the entire periphery except at the posteroventral angle. Dorsal margin gently arched, flattened along the hinge line, sloping toward the posterior. Ventral margin often nearly straight in the right valve, sometimes moderately indented toward the posteroventral angle; in the left valve convex, slightly indented toward the posterior. Anterior end broadly and evenly rounded, usually bearing several short spines, somewhat more strongly developed on the right valve. Posterior end somewhat compressed, gently sloping to the posteroventral angle, which is subacute in the right valve, broader and roundly pointed



FIGS. *1–3*.—*Cytheridea* (*Haplocytheridea*) *stenzeli* Stephenson, n. sp. *1*, Right valve, view of holotype no. 2295. *2*, Right valve, paratype no. 2296. *3*, Left valve, paratype no. 2297. All figures ×55.

[1] Published with the permission of Stanolind Oil and Gas Company.

in the left valve, and often faintly spinose. Ornamentation weak, with the general exterior of the valves smooth. Near the center of the carapace, a faintly impressed, irregularly undulating area is visible, which is usually marked by broad shallow pits. Hinge structure and muscle scar pattern typical for the subgenus *Haplocytheridea*.

Length of holotype no. 2295 (complete specimen) 0.77 mm.; height 0.45 mm.; width 0.42 mm. Length of paratype no. 2296 (right valve) 0.78 mm.; height 0.41 mm. Length of paratype no. 2297 (left valve) 0.78 mm.; height 0.48 mm.

Remarks.—*C.* (*H.*) *stenzeli* is fairly readily distinguishable from other Eocene species. It might possibly be confused with *C.* (*H.*) *montgomeryensis* Howe and Chambers, recently reported by me from the upper Claiborne (Stephenson, M. B., 1942, Jour. Paleontology, vol. 16, pp. 109, 110, pl. 18, figs. 17, 18). The new species is much more weakly ornamented, with no development of pitted, curvilinear furrows. It is likewise more tumid, and more strongly compressed on the posterior.

Type locality.—An exposure of the Reklaw formation, Claiborne Eocene, in Ridge Creek, which lies 6.2 miles west of the town of Smithville, on a gravel road to the small settlement of Upton (see Bastrop quadrangle), Bastrop County, Texas, Ridge Creek crosses the road about 0.8 miles east of Upton. The road crosses the creek on a small concrete bridge and a high railroad trestle is beside it. Ridge Creek is intermittent but has a deep course, steep sides, and it meanders considerably. It apparently is not named on the Bastrop quadrangle. The locality is almost a mile upstream (southwest) from the road crossing, at a prominent bluff. The upper 20–25 feet consist of very gypsiferous gray to brown shale. Below this is a dark greenish gray very glauconitic fossiliferous clay. The type material was taken about 2 feet below the top of this clay, just below a thin ironstone layer. (J. B. Garrett and C. F. Washburn loc. 182-C.)

MANUSCRIPT RECEIVED BY THE EDITOR, MARCH 22, 1942.

HALYMENITES, ADDENDUM

JOSEPH M. PATTERSON
1408 Alamo National Bldg.,
San Antonio, Texas.

In my article "Halymenites, a marine sandstone indicator," in the March 1942 issue of the JOURNAL OF PALEONTOLOGY, an important reference was overlooked. This is the paper entitled "Fossil Plants from the Colgate Member of the Fox Hills Sandstone and Adjacent Strata," by Roland W. Brown, appearing in the U. S. Geol. Survey Prof. Paper 189, Part 1, 1939, pp. 253–54.

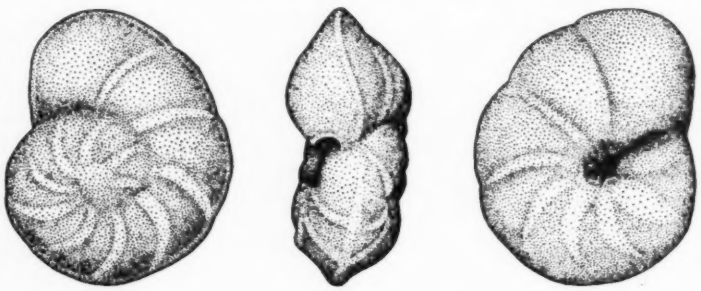
JOURNAL OF PALEONTOLOGY, VOL. 17, NO. 4, P. 484, 1 TEXT FIG., JULY 1942

A NEW SPECIES OF DISCORBIS FROM THE WECHES FORMATION OF TEXAS[1]

J. B. GARRETT

Stanolind Oil and Gas Company, Houston, Texas

DURING studies on the shallow water facies of the Weches and equivalent formations of the middle Eocene of the Gulf Coast, the writer has found an undescribed species of *Discorbis* to be among the more useful Foraminifera. Some time ago well-preserved specimens were discovered in outcrop material from East Texas, and this material now forms the basis for a new species.



FIGS. *1a-c.*—*Discorbis stenzeli* Garrett, n. sp., ×65. *1a*, Dorsal view; *1b*, apertural view; *1c*, ventral view, holotype no. 2410. Weches formation, Claiborne group, Eocene, Texas. (Drawings by Morton B. Stephenson).

1a 1b 1c

The specimens were obtained from a good exposure in a deep road cut on Texas Highway 21, located by road 16.0 miles east-southeast of its intersection with Texas Highway 26 at Nacogdoches. The upper part of the section consists here of 8 feet of ironstone underlain by approximately 12 feet of unweathered fossiliferous greensand marl. The specimen figured was taken from a sample collected about 3 feet below the base of the ironstone.

The species here described is named for Dr. H. B. Stenzel, who has done much work on the Claiborne group of Texas. The holotype and additional specimens will be deposited in the geological museum at Louisiana State University. Types will also be placed in the Cushman Laboratory for Foraminiferal Research.

[1] Published with the permission of the Stanolind Oil and Gas Company.

SYSTEMATIC DESCRIPTION

Family ROTALIIDAE

Genus DISCORBIS Lamarck

DISCORBIS STENZELI Garrett, n. sp.

Text figures 1a-c

Test of moderate size, heavily constructed, tightly coiled, almost equally biconvex; periphery subacute, slightly lobulate in the later portion; umbilical region on the ventral side deeply depressed; chambers distinct, moderately inflated, eight to nine in the final whorl; sutures curved, limbate, composed of clear material, raised except for the last one or two on the ventral side; wall on the dorsal side finely and closely punctate, on the ventral side much less punctate except in the peripheral portion of each chamber, the remaining surface being almost glassy in appearance; aperture a low arched opening on the ventral side of the periphery, provided with a slight overhanging lip.

Dimensions of holotype no. 2410 from Weches locality no. 156-A: maximum diameter, 0.58 mm.; thickness, 0.23 mm.

Remarks.—*Discorbis stenzeli* is easily distinguished from other species occurring in the Claiborne by its rather massive, heavily ribbed construction and by its glassy ventral appearance. The writer has found *D. stenzeli* to be restricted to the Weches and equivalent formations.

MANUSCRIPT RECEIVED BY THE EDITOR, OCTOBER 31, 1941.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 485–486, JULY 1942

THE SKELETON OF AN IMMATURE PELYCOSAUR, DIMETRODON CF. GRANDIS, FROM THE PERMIAN OF TEXAS

CHARLES W. STERNBERG
Walker Museum, University of Chicago

ABSTRACT—Skeletal remains of an immature pelycosaur from the Arroyo formation of Texas are described. While specific designation is not certain, it is suggested that this material represents a young individual of *Dimetrodon grandis*. The faunal association is listed.

RECENTLY there has appeared an excellent monograph by Romer and Price[1] reviewing the Pelycosauria of the southwestern United States. With few exceptions, the authors have discussed all the known pelycosaurian material in North American museums. In the vertebrate collections of Walker Museum there is a partial skeleton of an immature individual not included in the above mentioned monograph. The specimen (W. M. 1758) was collected by Dr. E. C. Olson during the summer of 1939. I am indebted to him for the privilege of describing this material.

The skeleton came from the Arroyo formation of the Clear Fork group, of Permian age. It was found at a locality commonly described as "*Labidosaurus* pocket" which lies in the breaks of Coffee Creek in the northern part of Baylor County, Texas. The following specimens have been found in the pocket:

Labidosaurus hamatus—parts of ten or more individuals,
Dimetrodon grandis—three or four partial skeletons,
Seymouria baylorensis—one individual,
Edaphosaurus sp.—a few vertebrae,
Cotylosaur indet.—a partial skull,
Amphibian indet.—partial skull of a small individual.

The fact that *D. grandis* occurs in this locality makes it probable that the skeleton here described is an immature individual of that species. It is unlikely that members of two species would inhabit the same restricted area contemporaneously, although, of course, it does happen. It is improbable that we shall ever have an adequate series of growth stages of this form, because conditions for preservation are unfavorable. Lacking this ontogenetic evidence, the present specimen cannot be given definite specific assignment.

When the specimen came into my hands for description, it had been prepared as a slab mount for teaching and exhibition purposes. The preservation of the bone is poor; It is probable the bony elements were never well ossified. For these reasons it was felt that a more detailed preparation should not be attempted and, because of this, many features of interest cannot be examined.

DESCRIPTION OF DIMETRODON CF. GRANDIS

Postcranially, the majority of the skeletal elements are represented. Of the skull, only four small pieces of jaws and a few other doubtful fragments remain. The skull material is of no value for descriptive purposes.

Axial skeleton.—At least 58 vertebrae are present; all but 3 are articulated, forming a continuous column. Of these, 15 are presacral, 3 are sacral, and the remaining 37 are caudals. The length of the column is approximately 65 centimeters; the caudal series measures 37 centimeters in length. This caudal series is by no means complete. If the vertebrae which lay behind the last one preserved be considered to have decreased in size at a uniform rate, there must have been twice as many caudals as are here shown. Nothing can be added to previous descriptions concerning the shape of the caudal vertebrae.

There is evidence of three sacral ribs fused to the pelvic girdle. The vertebrae themselves are so distorted it is impossible to make positive statements about them. They

[1] Romer, A. S. and Price L. W., 1940. Review of the Pelycosauria: *Geol. Soc. America Spec. Paper* no. 28.

appear to be as heavy as any in this specimen.

The last 5 presacrals comprise the lumbar series. These vertebrae are so oriented in the slab that they show neither ribs nor neural spines. Opposite the third one is a fragment of bone which appears to be part of a neural spine.

The anterior 10 presacral vertebrae bear both ribs and elongated neural spines. The spines are of the same type that are so characteristic in all specimens of *Dimetrodon;* it is chiefly on this evidence the material here examined is included in this genus. None of the spines is complete. The longest one, measured from zygapophyses to the end, is 9.8 cm. in length. All the spines are wider than long, this is probably due to transverse growth. Faint grooves can be seen on both anterior and posterior surfaces of these spines.

The ribs, where favorably exposed, show a double-headed condition. The two heads are not distinct, being separated only by a shallow notch. This tends to confirm Romer's (1940, p. 110) conclusion that two heads develop because of lack of ossification in the connecting web. The tuberculum is attached to the transverse process, the capitular attachment cannot be seen. In addition to the 10 ribs which are attached to the anterior vertebrae, the distal portions of the next four anterior ribs are preserved.

Appendicular skeleton.—A small part of the pectoral girdle is present. It is so crushed and broken however that, except for the scapula, none of the components can be distinguished. The humerus and radius are missing but the ulna and most of the elements of the manus are present. While the ulna has an appearance which is more characteristic of the radius, its distal articular surface lies in the correct relationship to the pisiform, ulnare, and intermedium. Further, Rømer (1940, p. 146) states the olecranon was apparently one of the last elements to ossify in ontogeny. The absence of this process in an immature individual is to be expected; in case of its absence there is little to distinguish the ulna from the radius in shape. The ulna is 6.3 centimeters in length, cylindrical through the shaft, and moderately bent. The proximal articular surface is very gently convex, the distal articulation shows a concave surface. Neither surface is well preserved.

The carpal elements are somewhat rounded and do not show the irregular shapes characteristic of the same bones in adult specimens. The following bones are present: ulnare, the largest bone in the wrist; pisiform; intermedium; radiale; lateral centrale; medial centrale; three distal carpals; five metacarpals; and six phalanges. Other bones of the manus may be present but, if so, they are concealed.

Although the pelvic girdle is present, it is so distorted by crushing that the various elements cannot be made out. A part of the vertebral column, which runs across the pelvis, further conceals it.

Both femora are present and about equal in length, the right one measures 7.1 cm. long. The articular surfaces are poorly developed and only the distal surface is well exposed. It is gently convex, not broken by the notch which, in adults, separates the articular areas of the tibia and fibula. A line normal to that part of the articular surface which serves the tibia would make an angle of about 30 degrees with the main shaft of the bone. The femora are expanded at both ends, the distal expansion being somewhat greater than that of the proximal end.

The right fibula and tibia are present. The former is 6.9 cm. in length, moderately arched, and rather small and cylindrical in the shaft but expanded at both ends. The distal end is much flattened. The tibia is but little shorter, 6.8 cm. Its proximal expansion is somewhat greater than that of the fibula. At the distal end the tibia is cylindrical and expanded but little more than the main shaft of the bone.

Not all the tarsal elements are present. Those which can be seen are subcircular in aspect. This is evidently due to lack of ossification and growth. The following segments can be identified: fibulare, the largest bone in the complex; intermedium; lateral centrale; medial centrale; two distal tarsals; parts of four metatarsals; and a few distal phalanges. The last few vertebrae lie above, but closely pressed against, the more distal bones of the pes, concealing some of them from view.

MANUSCRIPT RECEIVED BY THE EDITOR FEBRUARY 7, 1942

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 487–488, JULY 1942

FOUR NEW GENERA OF PALEOZOIC GASTROPODA

J. BROOKES KNIGHT

ABSTRACT—Four new genera are erected; *Loxobucania*, genotype *Bellerophon lindsleyi* Safford; *Aglaoglypta*, genotype *Bellerophon koeneni* Clarke; *Cymatospira*, genotype *Bellerophon montfortianus* Norwood and Pratten; and *Amphiscapha*, genotype *Straparolus* (*Euomphalus*) *reedsi* Knight. The new trivial name *Stegocoelia wortheni* is proposed to replace *Stegocoelia quadricarinata* (Worthen) preoccupied in this genus.

IN HELPING with the preparation of the subdivision on Paleozoic Gastropoda for the forthcoming new edition of *North American Index Fossils* now being prepared by Professors H. S. Shimer and R. R. Shrock, it appeared to me that four new genera or subgenera would be useful. The purpose of this brief paper is to establish such genera and to rename one species, the present name of which is a homonym.

LOXOBUCANIA Knight, n. gen.

Genotype *Bellerophon lindsleyi* Safford 1869 (pl. G).

Diagnosis. Shell bellerophontid with moderately wide umbilici. Whorls rounded or depressed. Apertural margin not expanding rapidly; a broad sinus in the anterior lip culminates in a slit, which generates a selenizone. Ornamentation revolving linear features running normal to the apertural margin and converging upon the slit and selenizone, generally interrupted by growth lamellae.

This genus is essentially the genus *Bucania* as conceived by Ulrich and Scofield in 1897 (p. 850). These authors referred to *Bucania* Hall some twenty species characterized among other things by revolving ornamentation normal to the apertural margins and converging upon the slit and selenizone. The ornamentation is frequently interrupted by strong lamellae. *Bellerophon sulcatinus* Emmons, 1842, genotype of *Bucania* Hall, although included in it by Ulrich and Scofield definitely does not belong to this group. In *Bucania sulcatina* the revolving ornamentation meets the apertural margin at an angle and is strictly parallel with the selenizone. Although wavy and crossed by growth lines, the lirae that constitute it are uninterrupted. This marked difference in the arrangement of the revolving ornamentation implies an important difference in shell growth in the two groups thought to be sufficient together with other less conspicuous features to set them apart generically if not into different families. Since the name *Bucania* Hall must be separated with its genotype from the species with converging revolving ornamentation (*Bucania* of Ulrich and Scofield), a new genus is here erected for the latter.

The genus is widely distributed geographically, and is seemingly confined to the Ordovician.

AGLAOGLYPTA Knight, n. gen.

Genotype *Bellerophon koeneni* Clark 1904 (p. 320).

Diagnosis. Like *Bellerophon* in all respects except that the ornamentation consists of quincunxially arranged pustules.

There are in the rocks of Middle and Upper Devonian age pretty well distributed throughout the world a group of species of bellerophontids characterized by ornamentation consisting of quincunxially arranged pustules. This group is distinctive enough to be easily recognizable, and has so narrowly limited a stratigraphic range that it would seem to be useful to distinguish it by a name of its own. The group is so very close to *Bellerophon* itself that in all probability it should be accorded no more than subgeneric rank.

CYMATOSPIRA Knight, n. gen.

Genotype *Bellerophon montfortianus* Norwood and Pratten 1855 (p. 74).

Diagnosis. Shape as in *Bellerophon* except that aperture flares periodically, leaving wave-like transverse plicae in the shell where each expansion of the aperture was partly resorbed and growth resumed. Selenizone narrow, occupying the middle of a dorsal depression. Umbilici narrow. Parietal inductura thickened and built up within the aperture to a strongly projecting pad. Ornamentation revolving lirae, which pass unbroken across the transverse plicae.

The well known *Bellerophon montfortianus* Norwood and Pratten of the American Pennsylvanian appears to rest most unconformably in the genus *Patellostium* Waagen, where it was placed by Ulrich and Scofield in 1897 and where it has remained until the present. Actually *Bellerophon macrostoma* Roemer, 1844, genotype of *Patellostium*, and *B. montfortianus* have almost nothing in common except spiral coiling and a conspicuously expanded aperture. Since there seems to be no old genus where *B. montfortianus* would be more at home, I am erecting for it a new one, *Cymatospira*.

AMPHISCAPHA Knight, n. gen.

Genotype *Straparolus* (*Euomphalus*) *reedsi* Knight 1934.

Diagnosis. Discoidal shells with the spire depressed and the umbilicus very wide and shallow. The outer margin of the upper surface commonly with a more or less erect and rugose carina; another horizontally projecting carina around the base.

In 1934 (p. 143) I showed that *Helix catillus* Martin, 1793 (cited as *Euomphalus catillus* Sowerby), genotype of *Schizostoma* Bronn 1834, is so closely similar to *Euomphalus pentangulatus* Sowerby, 1814, genotype of *Euomphalus* Sowerby 1814, that the two supposed genera are actually congruent. The junior name *Schizostoma* was placed in the synonymy of *Eumophalus*. And yet in common with most paleontologists that have dealt with them, I recognized (p. 145) that there is in the American Pennsylvanian a rather homogeneous and distinctive group of species that often have been referred by authors to *Schizostoma*. This I designated as the "group of *Euomphalus catilloides* Conrad." Since the species of this group are distinctive enough for easy recognition and since the group, as a whole, and its constituent species seemingly have both facial and stratigraphic significance, I propose to erect for them the new genus *Amphiscapha* with *Straparolus* (*Euomphalus*) *reedsi* Knight, 1934, as the genotype. The new genus perhaps had best be regarded as a subgenus of *Straparolus* Montfort, 1810.

This subgenus differs from the subgenus *Euomphalus* partly in the stronger development and the usually marked rugosity of the upper carina, partly in the very wide umbilicus which commonly reaches 180 degrees, and especially in the horizontally projecting and commonly rugose carina around the base. In *Schizostoma* the upper angulation is hardly carinate and not rugose, the umbilicus is quite as deep as in *Euomphalus* and the lower carina is slightly developed and is neither marginal, rugose nor projecting horizontally.

The range of *Amphiscapha* is Pennsylvanian and Permian.

STEGOCOELIA WORTHENI Knight, new name

It is found that *Loxonema quadricarinatum* Worthen, 1884 (p. 24) sometimes referred to *Murchisonia* and to *Aclisina* by authors is referable to the genus *Stegocoelia* Donald, 1889, where its trivial name is preoccupied by *Stegocoelia quadricarinata* (M'Coy, 1844). I therefore propose the name *Stegocoelia wortheni* Knight to replace it.

REFERENCES

CLARKE, J. M., *1904*, Naples fauna in western New York: *New York State Mus. Mem.* 6, part 2, Albany.

KNIGHT, J. B., *1934*, The gastropoids of the St. Louis, Missouri, Pennsylvanian outlier; VI, The Euomphalidae and Platyceratidae: *Jour. Paleontology*, vol. 8, pp. 139–166, pls. 20–26.

NORWOOD, J. C., and PRATTEN, H., *1855*, Notice of fossils from the Carboniferous series of the western states, belonging to the genera *Spirifer*, *Bellerophon*, *Pleurotomaria*, *Macrocheilus*, *Natica*, and *Loxonema*, with descriptions of eight new characteristic species: *Acad. Nat. Sci.* Philadelphia *Jour.* (2nd ser.), vol. 3, pp. 71–78, pl. 9, Philadelphia.

SAFFORD, J. M., *1869*, *Geology of Tennessee*, Nashville.

WORTHEN, A. H., *1884*, Descriptions of two new species of Crustacea, fifty-one species of Mollusca, and three species of Crinoids, from the Carboniferous formation of Illinois and adjacent States: *Illinois State Mus. Nat. History Bull.* 2, Springfield.

ULRICH, E. O., and SCOFIELD, W. H., *1897*, The Lower Silurian Gastropoda of Minnesota: *Geology of Minnesota Final Report*, vol. 3, part 2, pp. 813–1081, pls. 61–82, Minneapolis.

MANUSCRIPT RECEIVED BY THE EDITOR, APRIL 10, 1942.

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 489–520, JULY 1942

BIBLIOGRAPHY AND INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1939

HANS E. THALMANN
(Box 1528, Stanford University)

BIBLIOGRAPY AND INDEX FOR THE YEAR 1939

THE FOLLOWING bibliography comprises 347 titles of publications devoted exclusively or partly to Foraminifera. Publications issued during the year 1939 add to 236. For the year 1931 two titles, for the year 1932 eleven, for the year 1933 six, for the year 1934 four, for the year 1935 four, for the year 1936 three, for the year 1937 14, and 31 titles are added for the year 1938.

With respect to previously issued bibliographies for the years 1931 to 1938 inclusive, the present bibliography shows the lowest number of publications. It is quite possible that many papers of Foraminifera did not reach the writer on account of the outbreak of the world war in September, 1939. The writer wishes, therefore, again to urge all persons interested in a complete recording of foraminiferal literature, to bring any omission of titles or new forms of Foraminifera to his knowledge. For this end an agreement has been made with Dr. Hubert G. Schenck (Box 1528, Stanford University, California), that during the writer's absence in South America all communications referring to bibliography and index should be mailed to Dr. Schenck's address. Dr. Schenck will then, from time to time, forward information and publications to the writer on the safest possible way.

From the literature for the year 1939, there are recorded in the following index one new family, 30 genera, 3 subgenera, 544 new species, 70 varieties, 4 *nomina nova*, one *nomen nudum* and 65 forms, to which the *nomenclatura aperta* have been applied. In the supplements to the indexes for the years 1932 to 1938 additional 34 new species, and 7 varieties, and 20 forms (*nomenclatura aperta*) are listed.

The percentage of new forms, i.e., species and varieties, erected during 1939 is, as follows: from Cambrian and Triassic one new form each; from Silurian 6%, Devonian 1%, Carboniferous 1%, Permian 1%, Jurassic 4%, Cretaceous 6%, Eocene 30%, Oligocene 9%, Oligo-Miocene 3%, Miocene 29%, Pliocene 3%, and Subrecent and Recent 7%.

ACKNOWLEDGMENTS

During his stay in the United States, from June, 1941 to April, 1942, the writer had the unique opportunity to visit extensive private and public libraries, thanks to the kindness of the following persons or institutions, to whom he wishes to express his cordial thanks: Dr. H. G. Schenck and Dr. S. W. Muller of Stanford University, Dr. A. K. Miller of the State University of Iowa, Dr. N. D. Newell of the University of Wisconsin, Dr. J. A. Cushman at Sharon, Mass., the Library of the United States Geological Survey (Mr. J. M. Nickles) at Washington, D. C., Mrs. Helen Jeanne Plummer at Austin, Texas, Mr. R. Wright Barker in Houston, Texas, Dr. Emil Witschi of the Zoological Department, State University of Iowa, Dr. U. S. Grant, and Mr. M. N. Bramlette of the University of California at Los Angeles.

The services rendered by Mrs. Helen Jeanne Plummer in editorial reading and preparing for print of this bibliography and index, and Mrs. Heidi Thalmann's constant help in assembling the data and in encouraging the work are again gratefully acknowledged.

Homonyms.—In accordance with Articles 11, 34, 35, and 36 of the International Rules of Zoological Nomenclature, the following forms, erected during 1939, have to be regarded as *homonyms*, and, consequently, should be renamed by their respective authors within due time. It is astounding, however, how few "delinquents in nomen-

clature" are correcting their errors, even if they are advised by personal letter prior to the publication of the list of homonyms since 1931.

With regard to the following list, it must be emphasized that most probably many more homonyms are contained in the Index than actually cited. During his stay in this country the writer lost his card index of Foraminifera, which up to May, 1941, reached nearly the 50,000 mark, owing to hostilities which broke out in Palembang (Sumatra). It was, therefore, impossible to check the newly erected forms against this card index which contains over a million entries and more than 250,000 original photostat figures of published forms. The writer would be grateful for information on homonyms not listed here.

Ammodiscus exsertus Cushman, 1910, var. *minutus* Ireland, preoccupied by Paalzow, 1932.

Asterigerina alabamensis Cushman and Garrett, preoccupied by Cushman and McGlamery, 1938.

Camerina jacksonensis Gravell and Hanna, 1935, var. *globosa* Barker, preoccupied by Rutimeyer, 1850.

Cristellaria magna Mjatliuk, preoccupied by Costa, 1856.

Frondicularia applanata Wick, 1939, var. *gigas* Wick, preoccupied by Church, 1929.

——— *levis* Wick, preoccupied by Marsson, 1878.

GLADIARIA Wick, preoccupied by Wedekind, 1937.

Haplophragmoides columbiense Cushman, 1925, var. *evolutum* Cushman and McCulloch, preoccupied by Natland, 1938.

Lagena bicarinata (Terquem, 1882) var. *polita* Matthes, preoccupied by Chapman and Parr, 1937.

——— *magnifica* Matthes, preoccupied by Sidebottom, 1912.

——— *orbignyana* (Seguenza, 1862) var. *nuda* Matthes, preoccupied by Chapman, 1909.

Nonion decoratum Cushman and McGlamery, preoccupied by Jedlitschka, 1937.

PERISPHINCTINA Wick, preoccupied by Wedekind, 1937.

Proteonina compressa Cushman and McCulloch, preoccupied by Paalzow, 1932.

Pseudouvigerina triangularis Jennings, 1936, preoccupied by Dain, 1934.

Robulina angulata Reuss, 1851, var. *costata* Wick, preoccupied by d'Orbigny (*teste* Fornasini, 1902, and Eichenberg, 1934).

Robulina magna Wick, preoccupied by Costa, 1856.

Trochammina pacifica Cushman, 1925, var. *simplex* Cushman and McCulloch, preoccupied by Friedberg, 1902.

BIBLIOGRAPHY

1. ABEL, OTHENIO, Vorzeitliche Tiere im deutschen Mythos, Brauchtum und Volksglauben: Jena (Fischer), 304 pp., 186 text figs.
2. ABRARD, RENÉ, Origine et premières migrations des Orbitoides et des Lépidocyclines: *Soc. Biogéogr. Paris, Comptes rendus*, vol. 16, pp. 51–53.
3. ACOSTA, JOSÉ T., *Quinqueloculina torrei*, un nuevo foraminífero de la costa de Cuba: *Torreia*, No. 1, pp. 1–3, pl. 1.
4. ACOSTA, JOSÉ T., *Triloculina eburnea* d'Orbigny: *Torreia*, No. 2, pp. 1–4, pl. 2.
5. ADAMS, BRADFORD C., Distribution of Foraminifera of the genus *Bolivina* in Canada de Aliso, Ventura County, California: *Am. Jour. Sci.*, vol. 237, pp. 500–511, 1 text fig.
6. ADAMS, BRADFORD C., Foraminifera in zonal paleontology: *Sixth Pacific Sci. Congr., Proc.*, vol. 2, pp. 665–670, 2 charts.
7. ADAMS, JOHN EMERY, Subsurface geology: *Finding and Producing Oil*, first edition, *Am. Petroleum Inst.*, pp. 34–36.
8. ADAMS, JOHN EMERY, and others, Standard Permian section of North America: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1673–1681.
9. ALBERICI, ERMINIA, Osservazioni sui giacimenti fossiliferi eocenici dei dintorni di El-Fugha (Sahara Libica): *Soc. italiana sci. nat. Atti.*, vol. 78, pp. 357–368, pl. 22.
10. Anonymous, Marine deposits of the Arabian Sea: *Nature* (London), vol. 144, pp. 841, 842.
11. ARABU, N., Sur les faunes nummultiques des environs de la mer de Marmara et en particulier sur les foraminifères: *Acad. roumaine, Sect. sci., Bull.*, vol. 22, pp. 71–78. (*Non vidi*).
12. ARAMBOURG, G., La phase terminale du Nummulitique en Perse occidentale: *Soc. géol. France, Compte rendu*, fasc. 14, pp. 208–211.
13. ARNI, PAUL, Relations entre la structure régionale et les gisements minéraux et pétrolifères d'Anatolie: *Etudes Recherches Minieres Turquie M.T.A., Bull.*, No. 2, pp. 1–10, 1 geol. map.
14. ARNI, PAUL, Ueber die Nummuliten und die Gliederung des Untereocaens: *Eclogae geol. Helvetiae*, vol. 32, pp. 113–159, pls. 5–9, 22 text figs.
15. ASANO, KIYOSI, Pliocene (Upper Mizuho) Foraminifera from Japan: *Geol. Soc. Japan, Jour.*, vol. 46, No. 547, pp. 155–168. (In Japanese with summary in English).
16. ASANO, KIYOSI, Fossil Foraminifera from Oga Peninsula, Akita prefecture, Japan: *Geol. Soc. Japan, Jour.*, vol. 46, No. 551, pp. 413–427, 12 text figs. (In Japanese with summary in English.)
17. ASANO, KIYOSI, Limestones of the South Sea Islands under Japanese Mandate: *Jub. Publ. Commem. 60th Birthday of Prof. H. Yabe*, vol. 1, pp. 537–550. (In Japanese with summary in English.)

18. ASANO, KIYOSI, Foraminifera from Urasima Bank, Wakasa Bay: *Animal and Plant* (Japan), vol. 7, pp. 39–45. (In Japanese.)
19. AUGUSTA, JOSEF, and ZEBERA, A., O dirkonozci *Polyphragma cribrosum* Reuss z kridovych sedimentu od Vrapic na Kladensku: *Veda Prirodni*, vol. 19, pp. 277–279.
20. AVNIMELECH, M., Sur la présence des *Cuneolina* dans le Turonien de la Palestine: *Soc. géol. France, Compte rendu*, fasc. 10, pp. 140–142.
21. AVNIMELECH, M., *Choffatella decipiens* Schlumb., dans le Crétacé inférieur de la Syrie et de la Palestine: *Soc. géol. France, Compte rendu*, fasc. 11, pp. 162–164.
BARGMANN, H. E., *see* HOARE, C. A., and BARGMANN, H. E.
22. BARKER, R. WRIGHT, Species of the foraminiferal family *Camerinidae* in the Tertiary and Cretaceous of Mexico: *U. S. Nat. Mus. Proc.*, vol. 86, No. 3052, pp. 305–330, pls. 11–22.
23. BARTENSTEIN, HELMUT, Agglutinierende Brackwasser-Foraminiferen in Quell-Tümpeln Mitteldeutschlands: *Senckenbergiana*, vol. 21, pp. 374–378, 1 text fig.
24. BARTKO, L., Nummulinas kvarckavicsok. (Silex with *Nummulites*): Foldt. Kozlony, vol. 69, pp. 58–61 .(In Hungarian.)
25. BERMÚDEZ, PEDRO J., Resultados de la primera expedición en las Antillas del ketch "Atlantis" bajo los auspicios de las universidades de Harvard y Habana: Nuevo genero y especies nuevas de Foraminíferos: *Soc. cubana hist. nat. Mem.*, vol. 13, pp. 9–12, pls. 1, 2.
26. BERMÚDEZ, PEDRO J., Resultados de la primera expedición en las Antillas del ketch "Atlantis" bajo los auspicios de las Universidades de Harvard y Habana: Foraminíferos del genero *Recurvoides*, descripción de una especie nueva: *Soc. Cubana hist. nat. Mem.*, vol. 13, pp. 57–61, pl. 5.
27. BERMÚDEZ, PEDRO J., *Flintina clenchi*, un nuevo foraminífero de Puerto Plata, Santo Domingo: *Soc. Cubana hist. nat. Mem.*, vol. 13, pp. 199, 200, pl. 30.
28. BERMÚDEZ, PEDRO J., Resultados de la primera expedición en las Antillas del ketch "Atlantis" bajo los auspicios de las universidades de Harvard y Habana: Nuevo genero y especies nuevas de foraminíferos: *Soc. Cubana hist. nat. Mem.*, vol. 13, pp. 247–252, pl. 33.
29. BIEDA, FRANCISZEK, Numuliny z fliszu magurskiego z okolic Limanowy. (Les Nummulines du flysch de Magura aux environs de Limanowa): *Inst. géol. Pologne, serv. géol., Bull.*, vol. 9, pp. 1–4.
30. BLANCKENHORN, M., Bericht über die Fortschritte der geologischen Erforschung Palästinas von 1931 bis 1938: *Deutsch. Palästina-Ver., Zeitschr.*, vol. 62, pp. 22–51.
31. BOBEK, H., Forschungen im zentral-kurdischen Hochgebirge zwischen Van- und Urmia-See: *Petermanns Mitt.*, vol. 84, pp. 152–162, 8 pls., 11 text figs.
32. BOKOR, GYÖRGY, A Budai-hegyzég nyugati peremének földtani viszonyai. (The geology of the western border of the mountains of Buda): *Földt. Közlöny*, vol. 69, pp. 219–268, 4 text figs. (In Hungarian with summary in English.)
33. BRAND, E., Foraminiferen-Profil der Amaltheenstufe von Schlewecke bei Harzburg: Senckenbergiana, vol. 21, pp. 329–337.
34. BRANSON, C. C., Pennsylvanian formations of central Wyoming: *Geol. Soc. America Bull.*, vol. 50, pp. 1199–1226, 3 pls., 2 text figs.
35. BRAZHNIKOVA, N., Data for the study of Foraminifera of the central Dombas district: *Ukrainian S.S.R. Acad. Sci., Inst. Geol. Trans.*, pp. 145–160, 2 pls. (In Ukrainian with summary in English.)
36. BRAZHNIKOVA, N., Contribution to the Foraminifera of the central Dombas district (Ukraine): *Ukrainian S.S.R. Acad. Sci., Inst. Geol., Jour. Geol.*, vol. 6, pp. 245–289, 7 pls. (In Ukrainian with summary in English.)
37. BRIDGES, ROBERT C., Shallow Pleistocene marine shell stratum in Livingstone Parish, Louisiana: *Jour. Paleontology*, vol. 13, pp. 615, 616, 1 text fig.
38. BROTZEN, F., Zur Foraminiferenliteratur der letzten Jahre: *Geol. fören. Stockholm Förhandl.*, vol. 61, No. 2, pp. 1–5. (reprint).
39. BROWN, J. COGGIN, Contributions to the geology of the province of Yunnan in Western China. (10). The distribution, age, and relationships of the Red Beds: *Geol. Survey India, Rec.*, vol. 73, pp. 514–578, 2 pls.
40. BYKOVA, N. K., Foraminifera of the upper chalk and palaeogenic deposits of the Fergan valley: *Moscow "Gonti,"* 48 pp., figs. (In Russian; *non vidi*.)
41. BYKOVA, N. K., The Foraminifera from the Upper Cretaceous and Paleogene deposits of Ferghana: *Petrol. Geol. Prosp. Inst., Trans.*, series A, No. 121, pp. 1–39, pls. 1–4, 2 text figs.
42. CADY, GILBERT H., Significant uncertainties in Pennsylvanian correlation in Illinois coal basin: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1507–1524, 3 text figs.
43. CAMPBELL, ROBERT B., Deep test in Florida Everglades: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1713, 1714.
44. CAMPBELL, ROBERT B., Outline of the geological history of peninsular Florida: *Florida Acad. Sci., Proc.*, vol. 4, pp. 87–105, 11 text figs.
45. CANFIELD, CHARLES REITER, Subsurface stratigraphy of Santa Maria oil field and adjacent parts of Santa Maria Valley, California: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 45–81, 8 text figs.

46. CAUDRI, BRAMINE, Lepidocyclinen von Java: *Geol. mijnb. genootsch. Nederland en Kolonien, Verh.*, Geol. ser., vol. 12, No. 2, pp. 135–257, 10 pls., 22 text figs.
47. CHAPUT, ERNEST, Observations sur les terrains crétacés et tertiaires du Taurus oriental: *Acad. Sci. Paris, Comptes rendus*, vol. 208, pp. 2091–2092.
48. CHECCHIA-RISPOLI, G., Osservazioni geologiche preliminari lungo la Valle del Celone (Capitanata): *Acad. Lincei, Rendic.*, (6), vol. 29, pp. 452–454.
49. COLE, W. STORRS, Large Foraminifera from Guam: *Jour. Paleontology*, vol. 13, pp. 183–189, pls. 23, 24, 1 text fig.
COLE, W. STORRS, *see* VAUGHAN, T. W., and COLE, W. S.
COLE, W. STORRS, *see* VAUGHAN, T. W., COLE, W. S., and GRIMSDALE, T. F.
50. COLLET, L. W., and LOMBARD, A., Le flysch de l'Arête de Berroy entre le Col de Con et les Dents Blanches de Champéry: *Archives sci. phys. nat. Genève*, (5), vol. 2' pp. 87, 88.
51. COOKE, C. WYTHE, Boundary between Oligocene and Miocene: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1560, 1561.
52. CORRENS, CARL W., Pelagic sediments of the North Atlantic Ocean. In: Trask, P. D., Recent Marine Sediments.: *Am. Assoc. Petroleum Geologists*, Spec. Publ., pp. 373–395, 4 text figs. 10 tables.
53. CRESPIN, IRENE, Foraminifera in the Permian rocks of Australia: *Australian and New Zealand Assoc. Adv. Sci.*, 24th (Canberra) Meeting, *Rept.*, p. 94.
54. CUSHMAN, JOSEPH A., A monograph of the foraminiferal family *Nonionidae: U. S. Geol. Survey, Prof. Paper* 191, 100 pp., 20 pls.
55. CUSHMAN, JOSEPH A., Notes on some Foraminifera described by Schwager from the Pliocene of Kar Nicobar: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 149–154, pl. 10.
56. CUSHMAN, JOSEPH A., *Rupertia* (?) *adamsi*, a new species from the Pliocene of California: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 21–23, pl. 5.
57. CUSHMAN, JOSEPH A., Paleoecology as shown by the Foraminifera: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 40–43.
58. CUSHMAN, JOSEPH A., Eocene Foraminifera from submarine cores off the eastern coast of North America: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 49–76, pls. 9–12.
59. CUSHMAN, JOSEPH A., New American Cretaceous Foraminifera: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 89–93, pl. 16.
60. CUSHMAN, JOSEPH A., Recent literature on the Foraminifera: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 19, 20, 43, 44, 94–96.
61. CUSHMAN, JOSEPH A., and others, Report of the Committee on Micropaleontology. Appendix D of Annual Report of Division: *Nat. Research Council, Div. Geol. and Geogr.*, Washington, 9 pp. (mimeographed.)
62. CUSHMAN, JOSEPH A., and EDWARDS, PATRICIA G., Notes on the early described Miocene species of *Uvigerina: Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 33–40, pl. 8.
63. CUSHMAN, JOSEPH A., and ELLISOR, ALVA C., New species of Foraminifera from the Oligocene and Miocene: *Cushman Lab. Foram. Research Contr.*, vol. 15, pp. 1–14, pls. 1, 2.
64. CUSHMAN, JOSEPH A., and GARRETT, J. B., Eocene Foraminifera of Wilcox age from Woods Bluff, Alabama: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 77–89, pls. 13–15.
65. CUSHMAN, JOSEPH A., and LEROY, L. W., *Cribrolinoides*, a new genus of the Foraminifera: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 15–19, pls. 3, 4.
66. CUSHMAN, JOSEPH A., and MCCULLOCH, IRENE, A report on some arenaceous Foraminifera: *Univ. So. California Publ., Allen Hancock Pacific Exped.*, vol. 6, No. 1, pp. 1–113, pls. 1–12.
67. CUSHMAN, JOSEPH A., and MCGLAMERY, WINNIE, New species of Foraminifera from the lower Oligocene of Alabama: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 45–49, pl. 9.
68. CUSHMAN, JOSEPH A., and PARKER, FRANCES L., *Bulimina macilenta* Cushman and Parker, a new name: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 93, 94.
69. CUSHMAN, JOSEPH A., and SIEGFUS, STANLEY S., Some new and interesting Foraminifera from the Kreyenhagen shale of California: *Cushman Lab. Foram. Research, Contr.*, vol. 15, pp. 23–33, pls. 6, 7.
70. CUVILLIER, JEAN, Le Nummulitique au nord de Girga (Haute-Egypte): *Acad. Sci. Paris, Comptes rendus*, vol. 208, pp. 1919–1921.
71. CUVILLIER, JEAN, Crétacé et Nummulitique à l'est de Chaghab (Haute-Egypte): *Inst. d'Egypte, Bull.*, vol. 20, pp. 247–253, 1 text fig.
72. CUYLER, ROBERT H., Travis Peak formation of Central Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 625–642, 2 tables.
73. DACQUÉ, E., Die Fauna der Regensburger-Kelheimer Oberkreide (mit Ausschluss der Spongien und Bryozoen): *Bayer. Akad. Wiss. Math.-naturwiss Abt., Abh.*, N.F., vol. 45, pp. 1–218, 17 pls.
74. DAIN, L. G., Results of investigations on Mesozoic and Paleogene faunas of the Ukraine: *Ukrainian S.S.R. Acad. Sci., Inst. Geol., Science Trans.*, Conference on Petroleum, Kiev, pp. 265–268.
75. DARTEVILLE, EDM., La falaise d'Ambrizete. (Contribution à la géologie de l'Angola).: *Soc. Belge Géol. Pal. Hydrogéol., Bull.*, vol. 49, pp. 115–118, 1 text fig.

76. DAVIES, L. M., An early *Dictyoconus* and the genus *Orbitolina:* their contemporaneity, structural distinction and respective natural allies: *Royal Soc. Edinburgh, Trans.*, vol. 59, pp. 773–790, pls. 1, 2.
77. DEUSSEN, ALEXANDER, and OWEN, KENNETH DALE, Correlation of surface and subsurface formations in two typical sections of the Gulf coast of Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1603–1634, text fig. 1, table.
78. DOZY, J. J., Geological results of the Carstensz Expedition 1936: *Leidsche geol. Mededeel.*, vol. 11, pp. 68–131, 2 pls., 33 text figs.
79. DUBERTRET, LOUIS, Sur la génèse et l'âge des roches vertes syriennes: *Acad. Sci. Paris, Comptes rendus*, vol. 209, pp. 763–764.
80. DUNBAR, CARL O., Permian Fusulines from Central America: *Jour. Paleontology*, vol. 13, pp. 344–348, pls. 35, 36.
81. DUNBAR, CARL O., Permian Fusulines from Sonora: *Geol. Soc. America, Bull.*, vol. 50, pp. 1745–1760, 4 pls.
82. EARLAND, ARTHUR, Chalk: its riddles and some possible solutions: *Hertfordshire Nat. Hist. Soc. Trans.*, vol. 21, pp. 6–37, 2 pls.
83. EARLAND, ARTHUR, Some notes on selective building: *Hertfordshire Nat. Hist. Soc., Trans.*, vol. 21, pp. 106–114.
84. EATON, J. E., Danger in reporting fossils far beyond their indicated range and environment: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 250–253.
EDWARDS, PATRICIA G., *see* CUSHMAN, J. A., and EDWARDS, P. G.
85. ELLIS, A. D., JR., Significant Foraminifera from the Chickasawhay beds of Wayne County, Mississippi: *Jour. Paleontology*, vol. 13, pp. 423, 424, pl. 48.
ELLISOR, ALVA C., *see* CUSHMAN, J. A., and ELLISOR, A. C.
86. ENGELBERTS, F. G., Geologische waarnemingen in de Romagnoolsche Appenijnen: *Geol. en Mijnbouw*, vol. 1, pp. 240–252, 3 text figs.
87. ERDMAN, D. A., and KROL, G. L., De tertiaire gesteenten van den Carstensz-Expeditie: *Leidsche geol. Mededeel*, vol. 11, pp. 97–101.
88. ERK, A. SUAT, Gemlik mintakasinin jeolojik tetkiki. (Étude géologique de la région de Gemlik, Vilayet de Bursa): *Inst. géol. Univ. Istanbul, Publ.*, new series, No. 3, pp. 1–12, 1 text fig. (In Turkish and French.)
89. FABIAN, H. J., Wie ist die Ölhöffigkeit Bulgariens zu bewerten?: *Petroleum* (Wien-Berlin), vol. 35, pp. 477–481, 4 text figs.
90. FABRE, SUZANNE, Le Crétacé supérieur de la Haute-Vallee du Gapeau (Var): *Soc. géol. France, Comptes rendus*, fasc. 3, pp. 30–32.
91. FERENCZI, I., KULCZAR, K., and MAJZON, L., Ujabb adat Budapest földtani felepitesehez. (Neuerer Beitrag zur geologischen Kenntnis der Hauptstadt Budapest): *Földtani Közlöny*, vol. 69, pp. 166–177, 2 text figs. 1 table. (In Hungarian and German.)
92. FILIPESCU, M. G., Sur la nature et l'age des dépôts du soubassement du Sarmatien recontrés dans le forage de Horodnic-Bucovine (Roumanie): *Acad. roumanie, Sect. sci., Bull.*, vol. 21, pp. 30–34, 3 pls., 1 text fig.
93. FILIPESCU, M. G., L'étude pétrographique de quelques roches sedimentaires miocènes de l'Olténie (Roumanie): *Acad. Roumanie, Sect. sci., Bull.*, vol. 20, pp. 100–104, pls. 1–3.
94. FINLAY, H. J., New Zealand Foraminifera: Key species in stratigraphy. No. 1: *Royal Soc. New Zealand, Trans.*, vol. 68, pp. 504–533, pls. 68, 69 (part).
95. FINLAY, H. J., New Zealand Foraminifera: The occurrence of *Rzehakina, Hantkenina, Rotaliatina* and *Zeauvigerina: Royal Soc. New Zealand, Trans.*, vol. 68, pp. 534–543, pl. 69, 2 text figs.
96. FINLAY, H. J., New Zealand Foraminifera: Key species in stratigraphy. No. 2: *Royal Soc. New Zealand, Trans.*, vol. 69, pp. 89–128, pls. 11–14.
96a. FINLAY, H. S., New Zealand Foraminifera: Key species in Stratigraphy.—No. 3: *Royal Soc. New Zealand Trans. and Proc.*, vol. 69, part 3, Dec. 1939, pp. 309–329, pls. 24–29.
96b. FINLAY, H. S., The occurrence of *Calcarina mackay:* (Karrer) in Australia and New Zealand: *Rept. Australian Assoc. Adv. Sci.*, vol. 24, pp. 387–383.
97. FISK, H. N., Jackson Eocene from borings at Greenville, Mississippi: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1393–1403, 3 text figs.
98. Floridia, G. B., Osservazioni sul Miocene dei dintorni di Homs: *Soc. geol. Italiana, Boll.*, vol. 58, pp. 245–260, pl. 13.
99. FRANKE, ADOLF, A simple apparatus for sorting microfossils: *Jour. Paleontology*, vol. 13, pp. 225–227, 2 text figs.
100. FURON, RAYMOND, Sur la microfaune des marnes aquitaniennes à Lépidocyclines de Quom (Perse): *Soc. géol. France, Comptes rendus*, fasc. 6, pp. 79, 80.
101. FURRER, HEINRICH, Geologische Untersuchungen in der Wildstrubelgruppe (Berner Oberland): *Naturf. Ges. Bern, Mitt.*, a.d. Jahre 1938, (1939), pp. 35–167, 5 pls., 4 sections, 3 text figs.
102. GAGNEBIN, ELIE, Découverte d'un lambeau de la nappe de la Simme: *Acad. Sci. Paris, Comptes rendus*, vol. 208, pp. 822, 823.
103. GARRETT, J. B., Some middle Tertiary smaller Foraminifera from subsurface beds of Jefferson County, Texas: *Jour. Paleontology*, vol. 13, pp. 575–579, pls. 65–66.
104. GARRETT, J. B. Use of the name *Marginulina mexicana: Jour. Paleontology*, vol. 13, p. 622.

GARRETT, J. B., *see* CUSHMAN, J. A., and GARRETT, J. B.
GAULT, A. R., *see* MELLEN, F. F., and GAULT, A. R.

105. GINDRAT, H., Le Crétacé supérieur dans les klippes d'Oletta-Padrimonio (Corse): *Archives sci. phys. nat. Genève*, (5), vol. 21, pp. 74–76.

GOOCH, D. DAVID, *see* RUKAS, J. M., and GOOCH, D. D.
GRIMSDALE, THOMAS F., *see* VAUGHAN, T. W., COLE, W. S., and GRIMSDALE, T. F.

106. GRUBBS, DAVID M., Fauna of the Niagaran nodules of the Chicago area: *Jour. Paleontology*, vol. 13, pp. 543–560, pls. 61, 62, 1 text fig.

107. HAMNER, ED. J., Amelia oil field, Jefferson County, Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1635–1665, 6 text figs.

108. HANZAWA, SHOSHIRO, On the occurrence of *Acervulina*, an encrusting Foraminifera in the Jurassic Torinosu limestone from the Kwantô Mountainland, central Japan: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 201–203, pl. 12.

109. HANZAWA, SHOSHIRO, Stratigraphical distributions of the genera *Pseudoschwagerina* and *Paraschwagerina* in Japan, with description of two new species of *Pseudoschwagerina* from the Kitakami Mountainland, northeastern Japan: *Japanese Jour. Geology and Geography*, vol. 16, pp. 65–73, pl. 4.

110. HANZAWA, SHOSHIRO, Revision of "*Nummulites*" *cumingii* (Carpenter): *Japanese Jour. Geology and Geography*, vol. 16, pp. 225-232, pls. 15, 16.

111. HANZAWA, SHOSHIRO, Classification of the *Miogypsininae: Geol. Soc. Japan, Jour.*, vol. 46, pp. 335, 336. (In Japanese).

HANZAWA, SHOSHIRO, *see* HAYASAKA, I., TAN, K., and HANZAWA, S.

112. HARDERS-STEINHÄUSER, M., Über Ansammlungen und Fresspuren von *Arcella: Zool. Anz.*, vol. 125, pp. 97–102, 5 text figs.

113. HATAE, N., Stratigraphical division of Heian system on fossil Foraminifera: *Jub. Publ. Commem. 60th Birthday Prof. H. Yabe*, vol. I, pp. 551–552, pl. 29. (In Japanese with summary in English.)

114. HATAI, KOTORA M., A geological consideration of the fossils dredged from Japanese seas: *Geol. d. Meere und Binnengew.*, vol. 3, pp. 366–374, 1 text fig.

115. HAWKINS, HERBERT L., Humanity in geological perspective: *Smithsonian Rept.* for 1939, pp. 253–264.

116. HAYASAKA, ICHIRO, On a piece of *Fusulina*-limestone found in the Niki-Niki region, Timor: *Kwagaku (Science)*, vol. 9, pp. 86, 87.

117. HAYASAKA, ICHIRO, and ISHIZAKI, KAZUHIKO, On the occurrence of Eocene Foraminifera in the neighborhood of Besleo, Timor: *Taihoku Imp. Univ., Mem. Fac. Sci.*, vol. 22, No. 2 (Geol., No. 15), pp. 9–17, 1 pl., 2 text figs.

118. HAYASAKA, ICHIRO, and TAN, KEINOSUKE. On the occurrence of *Lepidocyclina* s.s. in Taiwan (Formosa) with the description of species by S. HANZAWA: *Imp. Acad. Tokyo, Proc.*, vol. 15, pp. 182–185, 4 text figs.

119. HEIM, ARNOLD, and HIRSCHI, HANS, A section of the mountain ranges of northwestern Siam: *Eclogae geol. Helvetiae*, vol. 32, pp. 1–16, 1 pl., 5 text figs.

120. HENBEST, L. G., LOHMANN, K. E., and MANSFIELD, W. C., Foraminifera, diatoms, and mollusks from test wells near Elizabeth City, N. C.: *U. S. Geol. Survey, Prof. Paper* 189-G, pp. 217–227, text figs. 28, 29.

121. HENSOLDT, ERNST, Palaeozän-anzeigendes Mikrofossilvorkommen von Mecklenburg als Aequivalent mariner Ablagerungen in Ostpreussen: *Zentralbl. f. Min.*, etc., Abt. B, pp. 12–24, 1 table.

122. HERITSCH, F., Karbon und Perm in den Südalpen und in Südost-Europa: *Geol. Rundschau*, vol. 30, pp. 529–588.

123. HERON, A. M., General report of the Geological Survey of India for the year 1938: *Geol. Survey India, Rec.*, vol. 74, pp. 1–132.

124. HILTERMANN, H., Neues aus der angewandten Mikropaläontologie (VIII): Tertiär, Oberkreide, Kimmeridge: *Oel und Kohle, vereinigt mit Petroleum*, vol. 45, p. 768.

HIRSCHI, HANS, *see* HEIM, A., and HIRSCHI, H.

125. HOARE, CECIL A., and BARGMANN, H. E., Protozoa: *Zool. Records*, London, pt. 2, pp. 1–85.

126. HOUGH, JACK L., Bottom-sampling apparatus: In: TRASK, P. D., Recent Marine Sediments, *Am. Assoc. Petroleum Geologists*, Spec. Publ., pp. 631–664, 17 text figs.

127. HOUSTON GEOLOGICAL SOCIETY STUDY GROUP, Datum planes for contouring the Gulf Coast region: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1404–1411, 2 text figs.

128. HOWE, HENRY V., Louisiana Cook Mountain Eocene Foraminifera: *Louisiana Dept. Cons., Geol. Bull.* No. 14, 122 pp., 14 pls., 2 tables.

129. HOWES, N. H., The ecology of a saline lagoon in south-east Essex: *Linn. Soc. London, Jour.* (*Zool.*), vol. 40, pp. 383–445, pls. 8, 9, 5 text figs., 11 tables.

130. HUNER, J., JR., Geology of Caldwell and Winn parishes: *Louisiana Dept. Cons. Geol. Bull.*, No. 15. 356 pp., 16 pls., 29 text figs.

HUZIMOTO, H., *see* MATSUMOTO, T., and HUZIMOTO, H.

131. IKEBE, NOBUO, Geologic structure of Santô and Syôgen districts, Heizyô coal field, Korea: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 433–444, 2 pls. (In Japanese.)

132. IRELAND, HUBERT A., Devonian and Silurian Foraminifera from Oklahoma: *Jour. Paleontology*, vol. 13, pp. 190–202, 75 text figs.

133. ISHIZAKI, KAZUHIKO, On the stratigraphical relations of the basaltic igneous rocks in the neighborhood of Mabutoku, Sintiku prefecture: *Taiwan Tigaku Kizi*, vol. 10, pp. 74–79, 1 text fig. (In Japanese.)

134. ISHIZAKI, KAZUHIKO, On the Foraminifera of the so-called upper marine fossil beds in the vicinity of Kwansai, Sintiku prefecture, Taiwan: *Taiwan Tigaku Kizi*, vol. 10, pp. 103–124, pls. 8, 9, 4 text figs. (In Japanese with summary in English.)

135. ISHIZAKI, KAZUHIKO A list of Japanese Neogene, Pleistocene and Recent Foraminifera, excluding *Orbitoididae*, recorded up to 1938: *Taiwan Tigaku Kizi*, vol. 10, Appendix, pp. 1–48 (parts 1 and 2).
ISHIZAKI, KAZUHIKO, *see* HAYASAKA, I., and ISHIZAKI, K.

136. JACOB, CHARLES, Discordances, transgressions et variations de faciès du Crétacé supérieur de la partie orientale des Pyrénées françaises: *Bulgar. geol. Ges., Zeitschr.* (Festschrift S. Bončev), vol. 11, pp. 39–47, 1 pl.

137. JASKÓ, SANDOR, Adatok az Alcsut-Etyeki dombvidék földtani ismeretéhez. (Geologische Beschreibung der Hügellandschaft von Alcsut-Etyek): *Földtani Közlöny*, vol. 69, pp. 109–130, 8 text figs.

138. KAHLER, F., Verbreitung und Lebensdauer der Fusulinen-Gattungen *Pseudoschwagerina* und *Paraschwagerina* und deren Bedeutung für die Grenze Karbon-Perm: *Senckenbergiana*, vol. 21, pp. 169–215, 6 text figs.

139. KAPTARENKO-CHERNOUSSOVA, O. K., Upper Tertiary microfauna of the Nicopol Manganese ore district (Ukraine): *Ukrainian S.S.R. Acad. Sci., Inst. Geol., Jour. Geol.*, vol. 6, pp. 199–223, 2 pls. (In Ukrainian with summary in English.)

140. KAPTARENKO-CHERNOUSSOVA, O. K., Foraminifera from the upper Cretaceous limestones of the Romny salt dome, Ukraine: *Ukrainian S.S.R. Acad. Sci., Inst. Geol., Sci. Trans.* (Conference on Petroleum, Kiev), pp. 269–286, 5 pls.

141. KELLER, B., The Foraminifera of the Upper Cretaceous deposits of U. S. S. R.: *Geol. Oil Prosp. Inst., Trans.*, series A, vol. 116, pp. 7–30, 2 pls., 4 tables. (In Russian, with summary in English.)
KEROHER, RAYMOND P., *see* MERCHANT, F. E., and KEROHER, R. P.

142. KÉZDIVÁSÁRHELYI-SZÖTS, E., Adatok a bajóti eocén öslénytani ismeretéhez. (Beiträge zur paläontologischen Kenntnis des Eozäns von Bajót): *Földtani Közlöny*, vol. 69, pp. 178–190, 1 pl. (In Hungarian with summary in German.)

143. KÉZDIVÁSÁRHELYI-SZÖTS, E., Amóri antalhegy órhamadkori kepzödményei. (Die paläozänen Bildungen des Antalberges): *Diss. Budapest*, 41 pp., 1 pl., 1 map. (In Hungarian with summary in German.)

144. KHVOROVA, I. V., The lower Carboniferous deposits of the western slope of the Urals within southern Bashkiria, Chkalov district, and North Kazakhstan: *Soc. naturalistes Moscou, Bull.*, new series, vol. 47, sect. géol., vol. 17, pp. 58–84, 1 text fig. (In Russian with summary in English.)

145. KLEINPELL, ROBERT M., Horizon of California Miocene in European scale: *Pan-Am. Geologist*, vol. 71, pp. 259–272, 1 text fig.
KLEINPELL, ROBERT M., *see* SCHENCK, H. G., and KLEINPELL, R. M.

146. KLINGHARDT, FRANZ, Das geologische Alter der Riffe des Lattengebirges (Süd-Bayern): *Deutsch. geol. Gesell., Zeitschr.*, vol. 91, pp. 131–140, pls. 2, 3, 2 text figs.

147. KOBAYASHI, TEIICHI, Discovery of *Fusulina* in limestone of the "Tamagawa" system: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 494, 495 (In Japanese.)

148. KORNFELD, M. M., Hackberry foraminiferal zonation in Starks field, Calcasieu Parish, Louisiana: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1835–1836.
KROL, G. L., *see* ERDMAN, D. A., and KROL, G. L.

149. KUDO, RICHARD ROCKSABRO, Protozoology. Enlarged and completely rewritten edition of "Handbook of Protozoology": Springfield and Baltimore (Thomas), 689 pp., 291 text figs.

150. KÜHN, OTHMAR, and ZINKE, GUSTAV, Die helvetische Kreide von Mattsee: *N. Jahrb. Min.* etc., Abt. B, vol. 81, pp. 327–346, pl. 11.
KULCZAR, K., *see* FERENCZI, I., KULCZAR, K., and MAJZON, L.

151. KUZNETSOV, S. S., and SERGEEV, V. A., On *Nummulites* from the lower Povoljiye (of the Volga) and the Priuralye: *Leningrad State Univ., Ann.*, Serv. géol. Issue 5, pp. 139–148, 1 pl., 1 map. (*non vidi.*)

152. LAIMING, BORIS, Some foraminiferal correlations in the Eocene of San Joaquin Valley, California: *Sixth Pacific Sci. Congr., Proc.*, vol. 2, pp. 535–568, 9 text figs.

153. LECALVEZ, J., *Troposphaera planorbulinae* n. gen., n. sp., protiste parasite du foraminifère *Planorbulina mediterranensis* d'Orb.: *Arch. Zool. Expérim. et Génér.*, vol. 80, pp. 425–443, 17 pls.

154. LECALVEZ, J., Foraminifères des côtes d'Indochine récoltés par G. Dawydoff: *Arch. Zool. Expérim. et Génér.*, vol. 80, pp. 93–95.

155. LEE, J. S., The geology of China: London (Murby), 528 pp., 93 text figs., maps.

156. LERICHE, M., Un gîte fossilifère dans le Bartonien du Meetjesland (Pays d'Eecloo) et sur le sens à donner au nom de Bartonien: *Soc. géol. Belge, Ann.*, vol. 62, pp. 552–559.

157. LERICHE, M., Notes paléontologiques: *Soc. géol. Belge, Bull.*, vol. 62, pp. B234–B239, 1 pl.

158. LEROY, L. W., Some small Foraminifera, Ostracoda, and otoliths from the Neogene ("Miocene") of the Rokan-Tapanoeli area, central Sumatra: *Natuurk. tijdschr. Ned.-*

Indië, vol. 99, pp. 215–296, 14 pls., 2 text figs.
LEROY, L. W., *see* CUSHMAN, J. A., and LEROY, L. W.
159. LINNAEI, CAROLI, *Systema naturae*. I. Regnum animale. A photographic facsimile of the first volume of the 10th edition (1758): London (British Museum of Natural History), 823 pp.
160. LIPPARINI, TINO, *Neoalveolina melo curdica* nel Miocene di en Nab (Tripolitania): *Soc. geol. italiana, Boll.*, vol. 58, pp. 299–304, pl. 14, 2 text figs.
161. LIPPARINI, TINO, Foraminiferi oligocenici di Umm-el-Breicat (Derna): *Tripoli, Mus. Libico Storia Nat., Mem.* vol. 1, pp. 287–299, 11 text figs.
LOHMANN, K. E., *see* HENBEST, L. G.
LOHMANN, K. E., and MANSFIELD, W. C.
162. LOMBARD, AUGUSTIN, *Nummulites* dans le flysch autochthone des environs de Monthey (Val d'Illiez, Valais): *Eclogae geol. Helvetiae*, vol. 32, pp. 220, 221.
163. LOMBARD, A., and SCHROEDER, W. S., Faciès peu connus du Crétacé supérieur des Préalpes medianes: *Archives sci. phys. nat. Genève*, (5), vol. 21, pp. 76–79.
LOMBARD, A., *see* COLLETT, L. W., and LOMBARD, A.
164. LOVE, JOHN DAVID, Geology along the southern margin of the Absaroka range, Wyoming: *Geol. Soc. America, Spec. Paper* No. 20, 134 pp., 17 pls., 3 text figs.
165. MACFADYEN, W. A., On *Ophthalmidium*, and two new names for recent Foraminifera of the family *Ophthalmidiidae: Royal Micr. Soc., Jour.*, (3), vol. 59, pp. 162–169, 3 text figs.
166. MACFADYEN, W. A., *Elphidium icenorum*, a new species of Foraminifera from the sub-recent deposits of the Cambridgeshire Fenlands: *Annals and Mag. Nat. Hist.*, (11), vol. 4, pp. 610–613, pl. 15.
167. MAJMIN, Z., Materials to the knowledge of Maikop deposits of Kerch peninsula: *Trans. geol. Oil prosp. Inst.*, series A, fasc. 117, pp. 1–36, map.
168. MAJZON, LADISLAUS, Fúrólaboratóriumi foraminifera-vizsgálatok. (Foraminiferenuntersuchungen des Bohr-Laboratoriums): *K. Ungar. geol. Anst., Jahresber. für 1933–1935* (1939), pp. 1023–1045, 8 tables. (In Hungarian and German.)
169. MAJZON, LADISLAUS, Budapestkörnyéki kattiai-rétegek foraminiferái. (Foraminiferen der Chattien-Schichten in der Umgebung von Budapest): *K. Ungar. geol. Anst., Jahresber. für 1933–1935* (1939), pp. 1047–1120, 17 tables. (In Hungarian and German.)
170. MAJZON, LADISLAUS, A láthatatlan koronatanuk. A mikroszkópikus kicsinységü kövületek. (Die unsichtbaren Kronzeugen. Fossilien von mikroskopischer Kleinheit): *Földtani Értesitö*, Budapest, new series, vol. 4, pp. 127–135, 2 text figs.
MAJZON, L., *see* FERENCZI, I., KULCZAR, K., and MAJZON, L.
171. MAKIYAMA, ZIRO, On the limestones in the Ooigawa formation (Miocene) and *Lepidocyclina* in them (eastern Totomi, Japan): *Geol. Soc. Japan, Jour.*, vol. 46, pp. 243–246. (In Japanese with summary in English.)
MCCULLOCH, IRENE, *see* CUSHMAN, J. A., and MCCULLOCH, I.
172. MANSFIELD, W. C., Note on unreported Oligocene in Citrus County, Florida: *Washington Acad. Sci., Jour.*, vol. 29, pp. 45, 46.
MANSFIELD, W. C., *see* HENBEST, L. G., LOHMANN, K. E., and MANSFIELD, W. C.
173. MARIE, PIERRE, Les *Nummulites*. Leur interprétation depuis Hérodote jusqu'à d'Orbigny: *Sciences Naturelles*, Paris, vol. 1, pp. 71, 72.
174. MARIE, PIERRE, Zones à foraminiféres du Crétacé moyen de Saint-Florentin (Yonne): *Soc. géol. France, Compte rendu*, fasc. 11, pp. 173–175.
175. MARIE, PIERRE, Sur la microfauna du Maestrichtien de Meschers, (Charente-Inférieure): *Mus. Nation. Hist. Nat. Paris, Bull.*, (2), vol. 11, p. 420.
176. MARIE, PIERRE, Sur la faune de foraminiféres de l'éstuaire de la Rance: *Lab. Maritime Dinard, Bull.*, vol. 20, pp. 68–86, 2 text figs.
177. MARLIÈRE, RENÉ, Les terrains post-paléozoiques au sondage no. 30 d'Hensies-Pommeroeul: *Soc. Belge Géol. Pal. Hydrogéol., Bull.*, vol. 69, pp. 103–107, 1 text fig.
178. MATSUMOTO, TATURO, and HUZIMOTO, HARYOSI, On a formation belonging to the Titibu system in Kamimaskui-gun, Kumamoto-ken, Kyusu: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 189–192, 1 text fig.
179. MATTHES, HORST WERNER, Die Lagenen des deutschen Tertiärs: *Palaeontographica*, vol. 90, Abt. A, pp. 49–108, pls. 3–8, 1 text fig., 1 table.
MCGLAMERY, WINNIE, *see* CUSHMAN, J. A., and MCGLAMERY, W.
180. MELLEN, F. F., and GAULT, A. R., New forms of the genus *Lituola* in Mississippi: *Am. Midland Naturalist*, vol. 22, pp. 470–473, text figs.
181. MERCHANT, FRANK E., and KEROHER, RAYMOND P., Some fusulinids from the Missouri series of Kansas: *Jour. Paleontology*, vol. 13, pp. 594–614, pl. 69, 1 text fig.
182. MEYER, WILLIS G., Stratigraphy and historical geology of Gulf Coastal Plain in vicinity of Harris County, Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 145–211, 8 text figs.
183. MJATLIUK, E. V., The Foraminifera from the upper Jurassic and lower Cretaceous deposits of the middle Volga region and Obshiy Syrt: *Trans. Geol. Oil. Prosp. Inst.*, series A, fasc. 120, pp. 1–76, 4 pls.
184. MOHR, C. L., Subsurface cross-section of Permian from Texas to Nebraska: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1694–1711, 3 text figs.

185. MOROZOVA, V. G., On the stratigraphy of the upper Cretaceous and lower Tertiary deposits in the Emba oil bearing district and the fauna of Foraminifera: *Soc. naturalistes Moscou, Bull.*, new series, vol. 47, sect. geol. vol. 17, pp. 59–86, 2 pls., 1 text fig., 2 tables.

186. MÜLLERRIED, FEDERICO K. G., Apuntes paleontológicos y estratigráficos sobre el Valle del Mezquital, Estado de Hidalgo: *Escuela Nacion. Mexico, Anales Ciencias Biol.*, vol. 1, pp. 225–256, pls. 40–43.

187. NEAVE, SHEFFIELD AIREY, *Nomenclator Zoologicus*. A list of the genera and subgenera in Zoology from the Tenth edition of Linnaeus 1758 to the end of 1938: London, vol. I, A-C, xiv+957 pp.; vol. II, D-L, 1025 pp.

188. OINOMIKADO, TUNETERU, On the foraminiferal fauna of the Tertiary sediments along the Nobe Valley, Niigate Prefecture: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 455–460, pl. 21, 3 text figs. (In Japanese with summary in English.)

189. OVEY, C. D., Report on Foraminifera: In J. R. Moir and A. T. Hopwood: Excavations at Brundon, Suffolk: *Prehist. Soc., Proc.*, new series, vol. 5, pp. 1–32, 18 figs., 2 pls.

OWEN, KENNETH DALE, *see* DEUSSEN, A., and OWEN, K. D.

PARKER, FRANCES L., *see* CUSHMAN, J. A., and PARKER, F. L.

190. PARR, W. J., Foraminifera of the Pliocene of southeastern Australia: *Mining and Geol. Jour., Melbourne*, vol. 1, pp. 65–70, 1 pl.

191. PASA, ANGELO, L'Eocene inferiore del Veronese occidentale: *Soc. italiana sci. nat., Atti.* vol. 78, pp. 346–356.

192. PÉREZ FARFANTE, ISABEL, Nuevos foraminíferos de Cuba: *Soc. cubana hist. nat., Mem.*, vol. 13, pp. 317–320, pl. 45.

PETROV, A. V., *see* VOLOSHINOVA, N. A., and PETROV, A. V.

193. PFENDER, J., Sur la valeur stratigraphique de *Cuneolina* d'Orb.: *Soc. géol. France, Compte rendu*, fasc. 11, pp. 170, 171.

194. PFENDER, J., Sur un calcaire phytogène du Lias inférieur d'Espagne et l'extension de ce faciès en quelques autres regions: *Soc. vaudoise sci. nat., Bull.*, vol. 60, pp. 213–223, pls. 1–5.

195. PHLEGER, FRED B., Foraminifera of submarine cores from the continental slope: *Geol. Soc. Amer. Bull.*, vol. 50, pp. 1395–1422, 3 pls., 4 text figs.

196. PINFOLD, E. S., The Dungham limestone and the Cretaceous-Eocene unconformity in Northwest India: *Geol. Survey India, Rec.*, vol. 74, pp. 189–198, pl. 12.

197. PRATJE, O., Sediments of South Atlantic Ocean: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1666–1672, 1 text fig.

198. RAO, RAMA L., On the occurrence of an Eocene bed in the Pondicherry Cretaceous area: *Current Science*, vol. 8, p. 167.

199. RAO, S. R. NARAYANA, *Lepidocyclina* from the Agate Conglomerates near Surat and Broach (western India): *Current Science*, vol. 8, pp. 167, 168, 1 text fig.

199a. RAUN, J. P. J., Etudes sur les mollusques du Paleocene de Copenhague: *Danske vid. Selsk., Skr. Bd.* 1, no. 1, 106 pp., 2 text figs., 4 plates.

200. REICHENOW, EDUARD, and WESTPHAL ALBERT, Morphologie und Entwicklungsgeschichte der Protozoa: *Fortschr. d. Zool.*, new series, vol. 4, pp. 59–69.

201. RUEDEMANN, RUDOLF, and SHROCK, ROBERT R., A new Wisconsin upper Cambrian foraminifer: *Am. Jour. Sci.*, vol. 137, pp. 66–71, 3 text figs.

202. RUKAS, JUSTIN M., and GOOCH, D. DAVID, Exposures of Vicksburg Oligocene in western Louisiana: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 246–250, 2 text figs.

203. SAMORODOVA, ANNA, Bibliography of Paleontology and Stratigraphy 1937–1938: *Probl. of Paleont.*, Moscow, vol. 5, pp. 397–453.

204. SCHÄFER, ANTON, Feuersteinbildung um einen Magenstein: *Zeitschr. Geschiebeforsch. und Flachlandgeol.*, vol. 15, pp. 98–103, 4 text figs.

205. SCHEFFEN, W., Phylogenetisch-biostratigraphische Betrachtungen an ostindischem Fossilmaterial (Foraminiferen und Brachyuren): *8. Nederl.-Ind. Natuurwet. Congr., Verhandl.*, Soerabaja, pp. 517–524, 9 text figs.

206. SCHENCK, HUBERT G., Fossils in Petroleum Geology: *Finding and Producing of Oil*, Am. Petrol. Inst., pp. 37, 38.

207. SCHENCK, HUBERT G., Khirtar *Nummulites* from southeastern Iran: *Geol. Soc. America, Bull.*, (Abstracts), vol. 50, p. 1973.

208. SCHENCK, HUBERT G., and KLEINPELL, ROBERT M., Regional significance of the Gaviota Foraminifera of California: *Geol. Soc. America, Bull.*, (Abstracts), vol. 50, p. 1973.

209. SCHMIDT-THOMÉ, P., Geologische Aufnahme der Alpenrandzone zwischen Bergen und Teisendorf in Oberbayern: *Deutsch. Geol. Gesell., Zeitschr.*, vol. 91, pp. 273–289, 1 pl., 3 text figs.

210. SCHINDEWOLF, O. H., Allgemeine Paläozoologie und Paläozoologie der Wirbellosen: *Fortschr. d. Zool.*, new series, vol. 4, pp. 287–306.

211. SCHOTT, WOLFGANG, Deep-sea sediments of the Indian Ocean: In: P. D. Trask, Recent Marine Sediments, *Am. Assoc. Petroleum Geologists*, Spec. Publ., pp. 396–408, 1 text fig.

212. SCHOTT, WOLFGANG, Rate of sedimentation of recent deep-sea sediments: In: P. D. Trask, Recent Marine Sediments, *Am. Assoc. Petroleum Geologists*, Spec. Publ., pp. 409–415, 2 tables.

213. SCHOTT, WOLFGANG, Paläogeographie und Tiefseesedimente des Atlantischen Ozeans: *Geol. Rundschau*, vol. 30, p. 382.

SCHROEDER, W. S., *see* LOMBARD, A., and SCHROEDER, W. S.

214. SEKI, TAKEO, The upper Paleozoic stratigraphy and structure of Mt. Ibuki, and its neighborhood: *Jub. Publ. Commem. 60th Birthday Prof. H. Yabe*, vol. 1, pp. 521–535. (In Japanese with summary in English.)

215. SEMIKHATOVA, E. N., Fusulinids from Carboniferous deposits of the Don-Medveditsa River region, Russia: *Rostov Univ., Trans. Geol. and Paleont., Sci. Mem.*, pp. 90–131, 3 pls., 1 text fig. (In Russian with summary in English.)
SERGEEV, V. A., *see* KUZNETSOV, S. S., and SERGEEV, V. A.

216. SHREVEPORT GEOLOGICAL SOCIETY, Upper and Lower Cretaceous of Southwest Arkansas, supplemented by contributions to the surface stratigraphy of south Arkansas and north Louisiana: *14th Ann. Field Trip, Guide Book*, 216 pp., many illustr., (lithographed, typewritten).
SHROCK, ROBERT., *see* RUEDEMANN, R., and SHROCK, R. R.

217. SIEGFUS, STANLEY S., Stratigraphic features of the Reef Ridge shale in southern California: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 24–44, 5 text figs.
SIEGFUS, STANLEY S., *see* CUSHMAN, J. A., and SIEGFUS, S. S.

218. SIGNORINI, ROBERTO, Osservazioni geologiche sull' alto Appennino bolognese: *Soc. geol. italiana, Boll.*, vol. 58, pp. 263–281, pl. 14.

219. SIGNORINI, ROBERTO, Il sottosuelo dell' Urbe e della Campagna: *Soc. geol. italiana, Boll.*, vol. 58, pp. lx–lxiii.

220. SILVESTRI, ALFREDO, Foraminiferi dell' Eoceno della Somalia: *Palaeontographica Italica*, vol. 32, suppl. 4, pp. 79–180, pls. 11–22.

221. SILVESTRI, ALFREDO, Illustrazione di specie caratteristica del Cretaceo superiore: *Soc. geol. italiana, Boll.*, vol. 58, pp. 225–234, pl. 12.

222. SILVESTRI, ALFREDO, Nummulitidi delle Alpi Apuane attribuite al Triassico: *Soc. geol. italiana, Boll.*, vol. 58, pp. 293–298, pl. 15.

223. SIMONS, ADOLF LEO, Geological investigations in N. E. Netherlands Timor: *Univ. Amsterdam, Dissertation*, 103 pp., 5 pls., 1 map, 29 text figs.

224. SOCIN, C., Fauna dei tufi basaltici dell'Eocene di Brentico (Monte Baldo, Trentino): *Studi Trentini Sci. Nat.*, vol. 20, pp. 63–114, 2 pls.

225. SOYER, ROBERT, La falaise éboulée d'Ivry-sur-Seine (Seine): *Acad. Sci. Paris Comptes rendus*, vol. 208, pp. 366–368.

226. STADE, G., and STAUDE, H., Mikrophotographie, Leipzig (Akad. Verlagsges.), 202 pp., 164 text figs.
STAUDE, H., *see* STADE, G. and STAUDE, H.

227. STENZEL, H. B., The Yegua Problem: *Texas Univ. Bull.* 3945, pp. 847–910, pls. 48–51, text figs. 129–134, 2 tables.

228. STSCHEDRINA, Z., A new genus of sand foraminifera from the Arctic seas: *Acad. Sci. URSS., Comptes rendus* (*Doklady*), vol. 24, pp. 95, 96, 2 text figs.

229. STUBBINGS, H. G., The marine deposits of the Arabian Sea; an investigation into their distribution and biology: *Brit. Mus. (Nat. Hist.), John Murray Expedition 1933–34, Sci. Repts.*, vol. 3, No. 2, pp. 31–158, 8 pls., 5 text figs., 20 tables.

230. STUBBINGS, H. G., Stratification of biological remains in marine deposits: *Brit. Mus. (Nat. Hist.), John Murray Expedition 1933–34, Sci. Repts.*, vol. 3, No. 3, pp. 159–192, 4 text figs., 8 tables.

231. STUBBS, SIDNEY A., Studies of Foraminifera from seven stations in the vicinity of Biscayne Bay: *Florida Acad. Sci., Proc.*, vol. 4, pp. 225–230, 2 tables.

232. SUBBOTINA, N., The Foraminifera of the lower Tertiary deposits of USRR: *Trans. Oil Geol. Inst.*, series A, fasc. 116, pp. 31–66, pls. 1–3.

233. SUZUKI, J., On the age of the Sambagawa system: *Imp. Acad. Tokyo, Proc.*, vol. 15, pp. 56–60, 13 text figs.

234. SZÖTS, ENDRE K., Adatok a Bajóti eocén őslénytani ismeretéhez. (Beiträge zur paläontologischen Kenntnis des Eozäns von Bajot): *Földtani Közlöny*, vol. 69, pp. 178–190, pl. 6.

235. TAN, KEINOSUKE, Foraminifera of the backbone range of Taiwan and its stratigraphical bearing: *Geol. Soc. Japan, Jour.*, vol. 46, pp. 344, 345 (In Japanese.)

236. TAN, KEINOSUKE, On the new localities of Eocene Foraminifera in the backbone ridge region of Taiwan and the geological age of the diabasic greenstone: *Taiwan Tigaku Kizi*, vol. 10, No. 1. (In Japanese, non vidi.)
TAN, KEINOSUKE, *see* HAYASAKA, I., and TAN, K.

237. TAN, SIN HOK, On *Polylepidina*, *Orbitocyclina*, and *Lepidorbitoides: De Ing. in Nederl.-Indië., IV. Mijnb. en Geol.*, vol. 6, pp. 53–84, 2 pls.

238. TAN, SIN HOK, The results of phylomorphogenetic studies of some larger Foraminifera (a review): *De Ing. in Nederl.-Indie, IV. Mijnb. en Geol.*, vol. 6, pp. 93–97.

239. TAN, SIN HOK, Remarks on the "letter classification" of the East Indian Tertiary: *De Ing. in Nederl.-Indië, IV. Mijnb. en Geol.*, vol. 6, pp. 98–101.

240. TAPPENBECK, DIETRICH, Geologie des Mollogebirges und einiger benachbarter Gebiete (Niederländisch Timor): *Univ. Amsterdam, Dissertation*, 105 pp., 8 pls., 17 text figs., 1 map, sections.

241. TATUM, E. P., Upper Cretaceous chalk in cap rock of McFaddin Beach salt dome, Jefferson County, Texas: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 339–342, 2 text figs.

242. TAUBER, A. F., Studien in Sarmat und Pannon des Küniglberg-Gloriettabergzuges in Wien: *Zweigstelle Wien Reichs-Anst. f. Bodenforsch., Verh.*, pp. 161–183.

243. TAUBER, A. F., Ein Aufschluss an der Grenze zwischen Sarmat und Pannon im XVII. Wiener Gemeindebezirk: *Zweigstelle Wien Reichs-Anst. f. Bodenforsch., Verh.*, pp. 205–209, 1 text fig.

244. TAUBER, A. F., Lithogenetische Untersuchungen an den Grenzschichten von Sarmat und Pannon am Südrand von Wien: *Zweigstelle Wien Reichs-Anst. f. Bodenforsch., Verh.*, pp. 260–270, 3 text figs.

245. TAYAMA, RISABURO, Correlation of the formations in the South Sea Islands: *Geol. Soc. Japan, Jour.*, vol. 64, pp. 345–348. (In Japanese).

246. TAYAMA, RISABURO, Preliminary report of the geology and mineral resources of Babeldaob (Palau Island): *Inst. Palau, South Sea Islands, Japan, Bull. Trop. Industr.*, vol. 3, pp. 1–19, 1 pl.

247. TAYAMA, RISABUTO, Terraces of the South Sea Islands under the Japanese Mandate: *Imp. Acad. Tokyo, Proc.*, vol. 15, pp. 139–141.

248. THALMANN, HANS E., Bibliography and Index to new genera, species and varieties of Foraminifera for the year 1936: *Jour. Paleontology*, vol. 13, pp. 425–465.

249. THALMANN, HANS E., Foraminifera: *Fortschr. d. Palaont.*, vol. 2, pp. 69–89.

250. THORP, E. M., Florida and Bahama marine calcareous deposits: In: P. D. Trask: Recent Marine Sediments, *Am. Assoc. Petroleum Geologists*, Spec. Publ., pp. 283–297, 1 text fig., 1 table.

251. TOLMAN, C. F., Some contributions to the geologic science by econòmic geologists: *Sigma Xi Quarterly*, vol. 27, no. 3, pp. 140–146.

252. TROMP, S. W., The value of generic determination in micro-stratigraphy: *Geologie en Mijnbouw*, vol. 1, pp. 202–204.

253. TSCHACHTLI, BERNHARD S., Gliederung und Alter der Couches Rouges und Flysch-Massen in der Klippen- und Simmen-Decke der Préalpes am Jaunpass: (Simmental): *Eclogae geol. Helvetiae*, vol. 32, pp. 39–46.

254. TZANKOV, V., Etudes stratigraphiques et paléontologiques du Danien de la Bulgarie du Nord: *Bulgar. geol. Ges., Zeitschr.*, (Festschr. S. Boncev), vol. 9, pp. 455–514, pls. 1–11, 5 text figs.

255. USPENSKAYA, Y. M., Materials on the study of foraminifers of the Kiev stage (Tertiary) of the Ukraine: *Kharkov State Univ. Proc., Book* 16, Geol. Inst. Trans., vol. 7, pp. 145–161. (In Russian with summary in English.)

256. VALLAT, E. H., Wasco field, Kern County, California: *Am. Assoc. Petroleum Geologists, Bull.*, vol. 23, pp. 1564–1567.

257. VAUGHAN, T. WAYLAND, and COLE, W. STORRS, *Operculina barkeri*, new name for *O. tuberculata* Vaughan and Cole, 1936.: *Jour. Paleontology*, vol. 13, p. 538.

258. VAUGHAN, THOMAS WAYLAND, COLE, W. STORRS, and GRIMSDALE, THOMAS F., Preliminary report on the Cretaceous and Tertiary larger Foraminifera of Trinidad, British West Indies: *Geol. Soc. America, Bull.* (Abstracts), vol. 50, p. 1941.

259. VECSEY, GY., A bakonyi Ajka-Urkut-Halimba környyékének eocén képzödményei. (Die eozänen Bildungen in der Umgebung von Ajka-Urkut-Halimba, Bakony-Gebirge): *Dissertation Budapest*, 46 pp., 1 pl., 1 map.

260. VENZO, SERGIO, Osservazioni geotettoniche e geomorfologiche sul rilevamento del foglio Belluno: *Soc. geol. italiana, Boll.*, vol. 58, pp. 433–451, pl. 23.

261. VITÁLIS, SANDOR, Alsó Triasz a bicskei medencében. (Untertrias im Becken von Bicske): *Földtani Közlöny*, vol. 69, pp. 101–108 (In Hungarian with summary in German.)

262. VOLOSHINOVA, N., On the Foraminifera from the Tertiary deposits of Sakhalin and Kamchatka: *Trans. Oil Geol. Inst.*, series A, fasc. 116, pp. 70–89, pls. 1–3, 2 tables. (In Russian and English.)

263. VOLOSHINOVA, N. A., and PETROV, A. V., Foraminifera occurring in the bays of the Okhotsk Sea (east coast of Sakhalin): *Trans. Petrol. Geol. Prosp. Inst.*, series A., fasc. 125, pp. 1–23, 1 pl., 3 tables.

264. WADIA, D. N., *Geology of India*. Second edition: London (Macmillan), 460 pp., 20 pls., 45 text figs.

265. WEBER, HANS. Foraminiferen des Tertiärs. II. Die Beziehungen der Foraminiferenfauna von Gross-Sachsen a. d. Bergstrasse zum Sediment: *Badische geol. Abh.*, Karlsruhe, vol. 10, pp. 25–37.

266. WEIN, GY. Szentendre környyékének földtani viszonayi. (Uber die geologischen Verhältnisse der Umgebung von Szentendre): *Földtani Közlony*, vol. 69, pp. 26–52, 1 pl., 1 text fig. (In Hungarian and German.)

WESTPHAL, ALBERT, *see* REICHENOW, E., and WESTPHAL, A.

267. WICHER, C. A., Neues aus der angewandten Mikropaläontologie. Alttertiär, Senon, Rhät-Lias-Grenze, Wert der Spühlbohrungen, Mikropaläontologie und Kartierung: *Petroleum*, Wien-Berlin, vol. 35, pp. 1–2, 1 text fig.

268. WICHER, C. A., Neues aus der angewandten Mikropaläontologie. Tertiär, Oberkreide, Alb, Feststellung von Störungen, Anwendbarkeit der Mikrostratigraphie auf ausserdeutsche Proben: *Petroleum*, Wien-Berlin, vol. 35, pp. 63–65.

269. WICHER, C. A., Neues aus der angewandten Mikropaläontologie. Allgemeines, Senon, Dogger, Lias.: *Petroleum*, Wien-Berlin, vol. 35, pp. 238–239.

270. WICHER, C. A., Neues aus der angewandten Mikropaläontologie. Tertiär, Apt, Valendis, terrestrische Unterkreide, Malm.: *Petroleum*, Wien-Berlin, vol. 35, pp. 579–581.

271. WICK, WERNER, Versuch einer biostrati-

graphischen Gliederung des jüngeren Tertiars auf Grund von Foraminiferen: *Preuss. geol. Landesanstalt Jahrb.*, vol. 59, 1938 (1939), pp. 476–512, pls. 18–23.

ZEBERA, A., *see* AUGUSTA, J., and ZEBERA, A.

272. ZEIJLMANS VAN EMMICHOVEN, C. P. A., De geologie van het centrale en oostelijke deel van de Westerafdeeling van Borneo: *Jaarb. mijnwezen, Ned.-Indië, Verhand.*, vol. 68, pp. 7–161, 9 pls., 9 photos, 7 text figs.

273. ZILCH, ADOLF, Die Typen und Typoide des Natur-Museums Senckenberg. 1. Protozoa (mit einem Vorwort von Rudolf Richter: Kataloge als Unterschied zwischen Aufsammlung und Sammlung): *Senckenberg Museum, Frankfurt a. M.*, 184 pp.

ZINKE, GUSTAV, *see* KUHN, O., and ZINKE, G.

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1931

274. ERHARDT, W., Der Staufen: geologische. Aufnahme der Berge zwischen Reichenhall und Innzell: *Alpenver. Innsbruck, Wiss. Veröff.* vol. 11, pp. 1–52. (=no. 277 for the year 1931.)

275. VASSOEVICH, N. B., The oil indications of Jinvani village (Georgia): *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 3, pp. 1–15, 4 text figs. (In Russian with summary in English;=no. 278 for the year 1931.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1932

276. EICHENBERG, W., Der stratigraphische Wert der Foraminiferen der Unterkreide im nordwestdeutschen Erdölbecken: *24. Jahresber. Niedersächs. geol. Ver. Hannover.* (Non vidi;=no. 345 for the year 1932.)

277. GOLINEZ, F. F., Geologic investigation in the Kalmizk-Salsk steppes: *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 7, pp. 1–45, 2 pls. (In Russian;=no. 346 for the year 1932).

HERITSCH, FRANZ, *see* KAHLER, G., and HERITSCH, F.

278. KAHLER, FRANZ, and HERITSCH, FRANZ, Die stratigraphische Gliederung der Nassfeldschichten: *Akad. Wiss. Wien, Math.-naturwiss Kl., Anz.*, vol. 69, pp. 242, 243. (=no. 347 for the year 1932.)

279. KARSTENS (CARSTENS), I. E., Geological investigations in the middle part of the Kahetinsky range. (Preliminary report of the work in the year 1930 in the region of the villages Gombory and Sagaredjo): *Trans. Petrol. Geol. Prospect. Inst.*, series B., fasc. 16, pp. 1–18, 3 text figs. (In Russian with summary in English; =no. 348 for the year 1932.)

280. KARSTENS, I. E., The Ananoor horizon: *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 35, 12 pp., 2 pls., 1 text fig. (In Russian;=no. 349 for the year 1932.)

281. KUDRIAVZEFF, N. A., Geologische Forschungen in der Zwischenflussweite der Kura und der Alasan: *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 32, 59 pp., 1 text fig., 1 map. (In Russian with summary in German;=no. 350 for the year 1932.

282. KUDRIAVZEV, N. A., Materials on the geology of oil fields of Phovel and Gurdjaan (Gruzia): *Trans. Petrol. Geol. Prospect. Inst.*, series B., fasc. 19, 20 pp., 4 test figs. (In Russian:=no. 351 for the year 1932.)

283. METZ, KARL, Detailaufnahme der Nassfeldschichten vom Schulterkofel nach West: *Akad. Wiss. Wien, math.-nat. Kl., Anz.*, vol. 69, pp. 243, 244. (=no. 352 for the year 1932.)

284. MISHUNINA, Z. A., On the stratigraphy of Cretaceous deposits of northern Kabristan: *Trans. Petrol. Geol. Prospect. Inst.*, series B., fasc. 14, pp. 1–11. (In Russian;=no. 353 for the year 1932.)

285. VASSOYEVITCH, N. B., Oil indications in the vicinity of the villages Udjarmo, Muhkhorvany, Sazkh enissi, Martkobi and Norio. (Reconnaissance geological investigations of the oil bearing zone north from Tiflis): *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 34, 54 pp., 16 text figs., 1 map. (In Russian;=no. 354 for the year 1932.)

286. WEBER, V. V., Geological sketch of the Neftik-Mayash district in Kabristan: *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 24, pp. 1–18, 3 text figs. (In Russian;=no. 355 for the year 1932.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1933

287. DARDER I PERICAS, B., Dues notas sobre geología de la Serra de Llevant de Mallorca. 1. L'existencia del Burdigalá a la Serra de Farrutx (Arta): *Inst. Catalana Hist. Nat., Butl.*, vol. 33, pp. 151–158, 1 text fig. (=no. 384 for the year 1933.)

288. DUNN, PAUL H., Microfaunal technique in the study of older Palaeozoics: *Illinois Acad. Sci., Trans.*, vol. 25, pp. 140, 141. (=no. 385 for the year 1933.)

EBERSINE, A. G., *see* ILYNE, S. I., and EBERSINE, A. G.

289. GOCEV, P., Uber einige wenig bekannte palaeogene Faunen Süd-Bulgariens: *Bulgar. geol. Ges., Zeitschr.*, vol. 5, pp. 177–214, 7 pls. (In Bulgarian and German;=no. 386 for the year 1933.)

290. ILÝNE, S. I., and EBERSINE, A. G., An essay on the structure of the zone of Tertiary deposits in South Abhasia: *Trans. Petrol. Geol. Prospect. Inst.*, series B, 27 pp., 1 map, 2 tables. (In Russian:=no. 387 for the year 1933.)

291. SAN MIGUEL DE LA CAMARA, S., and SOLÉ, LLUIS, Geologia del massís de Montgri: *Inst. Catalana Hist. Nat., Butl.*, vol. 33,

pp. 129–144, 3 pls., 5 text figs. (=no. 388 for the year 1933).

SOLÉ, LLUIS, *see* SAN MIGUEL DE LA CAMARA, S., and SOLE, LLUIS.

292. SOLÉ SABARIS, L., La geologia dels voltants de Figueres i la tectonica de l'Emporda: *Inst. Catalana Hist. Nat., Bull.*, vol. 33, pp. 250–257, 5 text figs. (=no. 389 for the year 1933.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1934

293. LLOPIS I LLADO, N., Al massís de Pedraforca: *Inst. Catalana Hist. Nat., Bull.*, vol. 34, pp. 155–157, pls. 9–14. (=no. 377 for the year 1934.)

294. VASSOEVICH, N., On the horizon with *Lyrolepis caucasica* Roman: *Trans. Petrol. Geol. Prospect. Inst.*, series B, fasc. 47, 23 pp. (=no. 378 for the year 1934.)

295. WEBER, H., Foraminiferen aus dem Lias delta von Freden im Leinetal: *Niedersachs. geol. Ver. Hannover, 26. Jahresber.* (=no. 379 for the year 1934.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1935

296. HDT., Mikropaläontologie, ein neues Hilfsmittel für die Auswertung von Bohrungen auf Erdöl und Kohle: *Pumpen-und Brunnenbau*, vol. 31, p. 12.(=no. 393 for the year 1935).

297. TOLSTIKHINA, M., Carboniferous deposits of the central part of the Ufa plateau: *Trans. Central Geol. and Prospect. Inst. Leningrad*, vol. 65, 40 pp., 8 text figs. (=no. 394 for the year 1935.)

298. TOMOR-THIRRING, J., Stratigraphie und Tektonik des Eozäns im nördlichen Bakony-Gebirge: *St. Tsiga Univ., Min.-geol. Inst., Abh.*, vol. 6, 20 pp., 2 text figs. (=no. 395 for the year 1935.)

299. VOLOSHINOVA, N., On Foraminifera of the oil-bearing deposits of eastern coast of Sakhalin: *Trans. Geol. Oil Prospect. Inst.*, series B, fasc. 51, 11 pp., 1 pl., 4 text figs. (In Russian with summary in English; =no. 396 for the year 1935.)

SUPPLEMENT OF BIBLIOGRAPHY FOR THE YEAR 1936

300. ASANO, K., Foraminifera from the Numa coral bed: *Geol. Soc. Japan, Jour.*, vol. 43, p. 921. (In Japanese;=no. 376 for the year 1936.)

301. DOUVILLÉ, FRANÇOIS, Foraminifères de Roscoff: *Stat. Biol. Roscoff, Trav.*, fasc. 14, pp. 51–57. (=no. 377 for the year 1936.)

302. RUSSEL, F. S., and YOUNGE, C. M., *The Seas, our knowledge of life in the sea and how it is gained* (revised edition): London (Warne), xiii—379 pp., 127 pls., 65 text figs. (=no. 378 for the year 1936.)

YOUNGE, C. M., *see* RUSSEL, F. S., and YOUNGE, C. M.

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1937

COE, W. R., *see* ALLEN, W. E., and COE, W. R.

303. BALAKHMATOVA, V., On the stratigraphy of the upper Cretaceous deposits of the middle Volga and the Obshyi Syrt: *Trans. Petrol. Geol. Prospect. Inst.*, fasc. 106, pp. 53–86, 3 pls., 3 text figs., (=no. 407 for the year 1937.)

304. BATURIN, V. P., *Paleogeography on the base of terrigenous components*, Baku-Moscow, 292 pp., 6 pls., 84 text figs., 63 tables. (In Russian with summary in English;=no. 408 for the year 1937).

BAYKAE, A. F., *see* PARÉJAS, E., and BAYKAE, A. F.

305. BLUMENTHAL, M. M., Esbozo geológico del Rif en la region de Bokoya: *Inst. geol. y miner. España, Bol.*, vol. 54, pp. 201–332, with illustr. (=no.409 for the year 1937.)

306. COE, W. R., and ALLEN, W. E., Growth of sedentary marine organisms on experimental blocks and plates for nine successive years: *Scripps Inst. Oceanography, Bull.*, tech. series, vol. 4, pp. 101–130, 2 pls., 10 text figs. (=no. 410 for the year 1937).

DONCIEUX, L., *see* FALLOT, P., and DONCIEUX, L.

307. FALLOT, P., and DONCIEUX, L., Nuevas observciónes sobre el Flysch del Rif espagñol: *Inst. geol. y miner. España, Bol.*, vol. 54, pp. 3–198, 4 pls., 38 text figs. (=no. 411 for the year 1937.)

308. GROZDILOVA, L. P., Fusulinids from the vicinity of the Simsk works in the southern Urals, Russia: *Trans. Petrol. Geol. Prospect. Inst.*, series A. fasc. 106, pp. 24–41, 3 pls., 3 text figs. (In Russian with summary in English;=no. 412 for the year 1937.) (*Non vidi;* contains new forms.)

309. HARNISCH, Otto, Neue Daten zur testaceen Rhizopodenfauna nicht moorbildender Sphagnete: *Zool. Anz.*, vol. 120, pp. 129–137, 1 text fig. (=no. 413 for the year 1937.)

310. KING, PHILIP B., Geology of the Marathon region, Texas: *U.S. geol. Surv.*, Prof. Paper 187, pp. 1–148, 24 pls., 33 text figs. (=no. 414 for the year 1937.)

311. KUFFERATH, A., Die Mikroskopiertechnik im Dienste der geologischem Forschung: *Zeitschr. prakt. Geologie*, vol. 45, pp. 60–64, 4 text figs. (=no. 415 for the year 1937).

312. MARIE, PIERRE, Sur la position relative de l'ouverture chez quelques foraminifères spiralés: *Soc. franç. Microscop., Bull.*, vol. 6, pp. 64–67, 4 text figs. (=no. 416 for the year 1937.)

313. ÖKONOMIDIS, G. T., Die inner-helvetischen Alpen: *Geol. Balkanica*, Sofia, vol. 2, pp. 101–125. (=no. 417 for the year 1937.)

314. PARÉJAS, E., and BAYKAE, A. F., Une lame de charriage à Sile (Kocaeli-Anatolie): *Univ. Istanbul, Fac. Sci., Revue*, vol. 3, pp. 44–49, 2 text figs. (=no. 418 for the year 1937.)

315. STUBBS, SIDNEY A., A study of the artesian water supply of Seminole County, Florida: *Florida Acad. Sci., Proc.*, vol. 2, pp. 24–36, 5 text figs., 1 table. (=no. 419 for the year 1937.)

316. VERNIORY, RENÉ, La géologie des collines du Faucigny, Préalpes externes (Haute-Savoie): Dissertation, Univ. Genève, No. 978, and *Bull. Inst. Nation. Genèvois*, vol. 51, pp. 37–139, 1 pl., maps. (=no. 420 for the year 1937.)

SUPPLEMENT TO BIBLIOGRAPHY FOR THE YEAR 1938

317. ANDRUSOV, D. N., Faune du Burdigalien et de l'Helvétien de la Slovaquie occidentale: *Assoc. Russe Recherches sci. Prague, Bull.*, vol. 8, sect. sci. nat. et math., No. 44, pp. 155–177, 2 pls. (=no. 314 for the year 1938.)

318. BEREGOV, R., Matériaux pour la géologie des environs d'Ivajlovgrad (Bulgarie du Sud-Est): *Bulgar. geol. Ges., Zeitschr.*, vol. 10, pp. 127–131, 4 text figs.(=no. 315 for the year 1938.)

319. BOCK, F. Protozoa. Urtiere: *Biol. d. Tiere Deutschlands*, vol. 1, pp. 1–199, 112 text figs. (=no. 316 for the year 1938.)

320. CHAVAN, A., and Dupuis, R., Le Lutétien inférieur à Montehauvet et Dammartin (S.-et-O.): *Mus. nat. histoire nat. Paris, Bull.*, vol. 10, pp. 531–535. (=no. 317 for the year 1938.)

321. COPELAND, HERBERT F., The kingdom of organisms: *Quart. Rev. Biol. Cambridge*, vol. 13, pp. 383–420, 9 text figs. (=no. 318 for the year 1938.)

322. COTTER, G. DE P., The geology of parts of the Minbu, Myingyan, Pakokku and lower Chindwin districts, Burma: *Geol. Survey India, Mem.*, vol. 72, pp. 1–136, 11 pls. (=no. 319 for the year 1938.)

323. DAVIES, L. M., Westward extension of the Ranikot Sea: *Nature* (London), vol. 141. p. 202. (=no. 320 for the year 1938.)

324. DREYFUSS, M., Études sur les sédiments argileux et argilo-calcaires de l'Oolithe franco-comtoise: *Soc. Hist. Nat. Doubs., Bull.*, vol. 48, pp. 51–82. (=no. 321 for the year 1938.)
DUPUIS, R., *see* CHAVAN, A., and DUPUIS, R.

325. FRENGUELLI, J., Noticias sobre sus actividádes científicas (1908–1938): Buenos Aires, 41 pp. (=no. 322 for the year 1938.)

326. GEIB, K. W., Stratigraphisch-tektonische Untersuchungen im Bereiche des Kartenblattes Waldböckelheim im Naheberglande un die tertiären Ablagerungen im westlichen Teile des Mainzerbeckens: *Ver. Erdkunde Darmstadt, Notizbl.*, (5), vol. 19, pp. 71–119, 1 pl., 2 text figs. (=no. 323 for the year 1938.)

327. GÉRARD, CH., and TÉTRY, A., Le Charmouthien de Meurthe-et-Moselle: *Soc. Sci. Nancy, Bull. mens.*, vol. 3, pp. 167–197. (=no. 324 for the year 1938.)

328. GROZDILOVA, L.P., Materials to the knowledge of the Ishimbaievo oil field: *Trans. Petrol. Geol. Prospect. Inst.*, series A, fasc. 101, pp. 90–141, 5 pls., 5 text figs. (=no. 325 for the year 1938.)

329. HARNISCH, Otto, Weitere Daten zur Rhizopodenfauna Lapplands. Ein Beitrag zur Ökologie sphagnophiler Rhizopoden: *Zool. Anz.*, vol. 124, pp. 138–140, 2 text figs. (=no. 326 fos the year 1938.)

330. HARRIS, R. W., POWELL, W., and REDDING, M., The microfauna of the Nanafalia (abstract): *Oklahoma Acad. Sci., Proc.*, vol. 18, p. 55.(=no. 327 for the year 1938.)

331. KAPOUNEK, JOSEF. Geologische Verhältnisse der Umgebung von Eisenstadt (Burgenland): *Geol. Bundes-Anst. Wien, Jahrb.*, vol. 88, pp. 49–102, 1 map. (=no. 328 for the year 1938.)

332. KUHN, O., Die Faunen des Malm alpha-delta im Frankenjura: *Gesell. naturf. Freunde Berlin, Sitzungsber.* pp. 374–397. (=no. 329 for the year 1938.)

333. LERICHE, M., Les rapports entre les formations tertiaires du bassin belge et du bassin de Paris: *Soc. géol. Belgique, Ann.*, vol. 62, Bull. 4, pp. 178–241, 3 pls., 4 text figs. (=no. 330 for the year 1938.)

334. LOMBARD, A., and Schroeder,W., Quelques faits nouveaux sur le Miocène de Saint-Florent (Corse): *Soc. phys. et histoire nat. Genève, Compte rendu*, vol. 55, pp. 81–85, 2 text figs. (=no. 331 for the year 1938.)

335. MARIE, PIERRE, Sur les foraminifères des bassins à flot de Saint-Malo: *Labor. Maritime Dinard, Bull.*, vol. 18, pp. 31–33. (=no. 332 for the year 1938.)

336, MORET, LÉON, Contribution à la paléontologie des couches crétacées et éocènes du versant sud de l'Atlas de Marrakech: *Protect. Republ. Franç. Maroc, Serv. Mines et Carte géol., Mem. Pal.*, vol. 11, 78 pp., 12 pls., 11 text figs. (=no. 333 for the year 1938.)

337. PFENDER, J., Étude micrographique des calcaires crétacés et éocènes de l'Imini, de Tamdakht et de Skoura: In: L. Moret, see no. 336, *Protect. Rep. Franç. Maroc, Serv. Mines et Carte géol., Notes et Mém.* vol. 49, *Mem. Pal.* vol. 11, chapter 4, pp. 57–71, text figs. 6–11. (=no. 334 for the year 1938.)
POWELL, W., *see* HARRIS, R. W., POWELL, W., and REDDING, M.

338. PUTZER, HANNFRIT, Die Rhät- und Liasablagerungen am Seeburg bei Gotha, am Rhönbergrücken und bei Eisenach: *Jenaische Zeitschr. f. Naturwiss.*, vol. 71, new series, vol. 64, pp. 326–444, pls. 6–15, 14 text figs. (=no. 335 for the year 1938.)

339. RAMPI, L., A propos de la *Silicotextulina deflandrei* Freng.: *Soc. franç. microscopie Bull.*, vol. 7, pp. 46–50, 12 text figs. (=no. 336 for the year 1938.)
REDDING, M., *see* HARRIS, R. W., POWELL, W., and REDDING, M.
SCHROEDER, W., *see* LOMBARD, A., and SCHROEDER, W.

340. STEFANINI, G., Cenni sulle località fossilifere eoceniche della Somalia: *Paleontographica Italica*, vol. 32, Suppl. 3, pp. 13–47, illustr. (=no. 337 for the year 1938.)
341. STUBBINGS, H. G., Marine sediments from islands and reefs of the Great Barrier Reef: *Great Barrier Reef Comm., Rept.* vol. 4, pp. 97–104. (=no. 338 for the year 1938.)
342. SUBBOTINA, N. N., Investigations of the Maikop series in north Caucasus: *Trans. Geol. Petrol. Prospect. Inst,*. series A, fasc. 104, pp. 43–62, 1 pl., 4 tables. (In Russian; =no. 339 for the year 1938.)
343. TAN, KEINOSUKE, Report on the survey of Sanshikyaku oil field in Taihoku prefecture: *Bureau of Resources and Industries, Publ.* no. 806 pp. 1–26, maps. (=no. 340 for the year 1938.)
344. TAYAMA, RISABURO, Topography, geology and coral reef of Saipan (preliminary report): *Tropical Industries Inst. Palau, South Sea Islands, Bull.*, vol. 1, pp. 1–62, 4 maps. (=no. 341, for the year 1938.)
TÉTRY, A., *see* GÉRARD, CH., and TÉTRY, A.
345. VALKANOV, A., Uber die Fortpflanzung von *Gromia dujardini* M. Schultze: *Arch. Protistenkunde*, vol. 90, pp. 393–395. (=no. 342 for the year 1938.)
346. WILMARTH, M. GRACE, Lexicon of geologic names of the United States (including Alaska): *U. S. geol. Surevy, Bull.* 896, part 1(A–L), 1244 pp.; part 2 (M–Z), pp. 1245–2396. (=no. 343 for the year 1938.)
347. YABE, HISAKATSU, Carboniferous-Permian deposits of the Japanese Islands, Tyôsen (Korea) and Manchuria: *2. Congr. Stratigr. Carbon., Heerlen* 1935, Maestricht 1938, *Comptes rendus*, pp. 1617–1649. (=no. 344 for the year 1938.)

GENERAL INDEX

(The numbers refer to the publications of the preceding Bibliography.)

General (Handbooks, Biology, Systematics, Habitat, Paleogeography, Palecology, etc.): 1, 2, 38, 51, 54, 57, 61, 62, 76, 82–84, 94–96, 110–112, 115, 138, 145, 149, 153, 159, 170, 173, 200, 204, 205, 210, 212, 230, 237–239, 249, 251, 273, 302, 304, 306, 312, 319, 321, 345, 346.
Applied Micropaleontology: 6, 7, 168, 206, 251, 267, 296.
Methods and Technique: 99, 126, 168, 226, 252, 288, 306, 311.
History: 173.
Bibliographies: 38, 60, 125, 203, 248, 249, 325.
Nomenclature and Taxonomy: 68, 76, 104, 110, 111, 125, 159, 165, 187, 237, 248, 273.
Reworking: 24.

STRATIGRAPHIC INDEX

Paleozoic (general): 131, 138, 147, 155, 178, 288, 308, 310.
Cambrian: 201.
Silurian: 106, 132.
Devonian: 132.
Carboniferous: 34, 36, 42, 116, 122, 138, 144, 147, 155, 164, 181, 214, 215, 278, 283, 297, 308, 347.
Permian: 8, 39, 53, 80, 81, 109, 119, 122, 138, 147, 155, 184, 214, 308, 347.
Triassic: 222, 261.
Liassic: 33, 193, 194, 267, 295, 327, 338.
Jurassic: 108, 124, 183, 324, 332.
Cretaceous: 13, 19, 20, 21, 40, 41, 47, 59, 71–74, 76, 79, 82, 88, 90, 92, 93, 95, 96a, 101, 102, 105, 123, 124, 140, 141, 146, 150, 163, 174, 175, 177, 180, 183, 185, 186, 193, 209, 216, 221, 223, 237, 240, 241, 253, 254, 258, 264, 267–270, 272, 275, 276, 279, 280, 282, 284, 291–293, 303, 307, 313, 314, 316, 322, 336, 337.
Tertiary (general): 17, 22, 35, 36, 40, 47, 78, 87, 89, 94–96, 124, 135, 157, 188, 208, 218, 219, 239, 246, 255, 258, 267–272, 299, 315, 326, 344.
Eocene: 9, 11, 12, 14, 17, 22, 29–32, 40, 41, 48, 50, 58, 64, 68–71, 74–77, 88, 91, 94, 95, 96a, 97, 101, 117, 118, 121, 123, 127, 128, 130, 136, 142, 143, 151, 152, 156, 157, 162, 177, 182, 185, 191, 196, 198, 199a, 207, 209, 220, 223–225, 227, 232, 234–237, 245, 256–260, 264, 272, 275, 277, 281, 286, 289, 290, 294, 298, 305, 307, 313, 318, 320, 322, 323, 333, 336, 340, 344.
Oligocene: 11, 12, 17, 22, 51, 63, 67, 77, 85, 91, 96, 96a, 96b, 100, 103, 107, 127, 148, 161, 167, 169, 172, 179, 182, 202, 208, 245, 256, 258, 264–266, 307, 342, 344.
Miocene: 5, 17, 22, 32, 45, 46, 49, 51, 62, 63, 85, 96, 96a, 96b, 98, 103, 120, 127, 137, 145, 158, 160, 171, 179, 182, 199, 217, 242–245, 247, 256, 258, 266, 277, 285, 287, 317, 331, 334, 343, 344.
Pliocene: 5, 16, 17, 45, 55, 56, 65, 96, 96a, 96b, 120, 134, 135, 139, 158, 190, 242–244, 262, 331, 344.
Pleistocene: 16, 37, 120, 134, 135, 195, 213, 262, 344.
Recent and Subrecent: 3, 4, 10, 15, 18, 23, 25–28, 52, 65, 66, 110, 112, 114, 129, 153, 154, 165, 166, 189, 192, 195, 197, 211–213, 228–231, 250, 263, 300–302, 306, 309, 329, 335, 339, 341, 345.
Brackish water: 23, 129, 166.

GEOGRAPHIC INDEX

(Countries are in alphabetical order)

AFRICA
Egypt: 70, 71.
Libya: 9, 98, 160, 161.
Morocco: 305, 307, 336, 337.
Portuguese East Africa: 75.
Somalia: 220, 340.

AMERICA
Central America:
Bahama: 250.
Cuba: 3, 4, 25–28, 192.
Guatemala: 80.
Mexico: 22, 81, 186, 237, 257.
Dominican Republic: 27.
North America (general): 8, 58, 59, 346.
Alabama: 64, 67.
Arkansas: 216.
California: 5, 45, 56, 68, 69, 145, 152, 208, 217, 256, 306.
Florida: 43, 44, 172, 250, 315.
Gulf Coast: 127.

Illinois: 42, 106.
Kansas: 181, 184.
Louisiana: 37, 63, 128, 130, 148, 202.
Mississippi: 85, 97, 180.
Nebraska: 184.
North Carolina: 120.
Oklahoma: 132, 184.
Tennessee: 59.
Texas: 72, 77, 103, 107, 182, 184, 227, 241, 310.
Wisconsin: 201.
Wyoming: 34, 164.
South America:
Trinidad: 258.

ASIA
Asiatic Russia and Caucasus: 40, 41, 141, 144, 185, 228, 232, 262, 263, 275, 277, 279–282, 284–286, 290, 294, 297, 299, 308, 328, 342.
British India: 123, 196, 198, 199, 264, 323.
Burma: 322.
China: 39, 155.
Formosa: 118, 134, 235, 236.
Indochina: 154.
Iran: 12, 100, 207.
Japan: 15, 16, 18, 108, 109, 113, 114, 131, 133, 135, 147, 171, 178, 188, 214, 233, 300, 343.
Korea: 347.
Manchuria: 347.
Palestine: 20, 21, 30.
Siam: 119.
Syria: 79.
Turkey: 11, 13, 31, 47, 88, 314.

EUROPE
Austria: 122, 138, 150, 242–244, 278, 283, 331.
Belgium: 156, 157, 177, 333.
Bulgaria: 89, 254, 289, 313, 318.
Corsica: 105, 334.
Czechoslovakia: 19, 317.
Denmark: 199a.
England: 82, 129, 166, 189.
France: 14, 90, 136, 174–176, 193, 225, 301, 316, 320, 324, 327, 335.
Germany: 23, 33, 73, 121, 124, 146, 179, 209, 265, 267–271, 273, 274, 276, 295, 326, 332, 338.
Hungary: 24, 32, 91, 137, 142, 143, 168, 169, 234, 259, 261, 266, 298.
Italy: 14, 48, 86, 191, 218, 219, 221, 222, 224, 260.
Lapland: 329.
Poland: 29.
Roumania: 92, 93.
Russia: (USSR): 35, 36, 74, 139–141, 151, 167, 183, 215, 255, 303.
Spain (and Majorca): 193, 194, 221, 287, 291–293.
Switzerland: 14, 50, 101, 102, 162, 163, 253.

OCEANIA
Netherlands East Indies (general): 239.
Australia: 53, 96b, 190, 341.
Borneo: 272.
Guam: 49.
Java: 46, 65.
New Guinea: 78, 87.
New Zealand: 94–96, 96a, 96b.
Nicobar: 55.
South Sea Islands: 17, 245, 246, 247, 344.
Sumatra: 158.
Timor: 116, 117, 223, 240.

OCEANS
Adriatic Sea: 165.
Atlantic: 52, 176, 195, 197, 213, 301, 335.
Arabian Sea: 10, 229–231.
Arctic Seas: 228, 263.
Caribbean and Gulf of Mexico: 25–28.
Indian: 211.
Mediterranean Sea: 339.
Pacific: 65, 66, 341.

INDEX TO NEW GENERA, SPECIES, AND VARIETIES OF FORAMINIFERA FOR THE YEAR 1939

(The numbers in bold-face type following the author's name in the Index refer to the publications of the preceding Bibliography.)

Acervulina inhaerens Schultze, 1854, var. *huzimotoi* Hanzawa, **108,** p. 202, pl. 12, figs. 1, 2. Jurassic, Japan.

Alveolina subpyrenaica Leymerie, 1846, var. *flosculina* Silvestri, **220,** p. 108, pl. 17, figs. 4, 5. Middle Eocene, Somaliland.

——— *terebrata* Silvestri, **220,** p. 115, pl. 13, figs. 15–17; pl. 17, fig. 1; pl. 18, fig. 1. Lower Lutetian, Somaliland.

Alveolophragmium planum Bykova, **41,** p. 19, pl. 1, fig. 10, text fig. 1. Upper Cretaceous, Ferghana, USSR.

Ammobaculites catenulatus Cushman and McCulloch, **66,** p. 90, pl. 7, figs. 11–14. Recent, Pacific, off Lower California, Mexico, 20 fathoms.

——— *hayasakai* Ishizaki, **134,** p. 113, pl. 8, fig. 7; pl. 9, fig. 1. Middle Miocene, Taiwan.

——— *huneri* Howe, **128,** p. 30, pl. 1, fig. 15. Eocene, Cook Mountain formation, Louisiana.

——— *ineptus* Cushman and McCulloch, **66,** p. 89, pl. 7, fig. 6. Recent, Pacific, off Panama, 12 fathoms.

——— *infravolgensis* Mjatliuk, **183,** p. 45, pl. 2, figs. 17, 18. Upper Jurassic, Middle Volga region, USSR.

——— *pseudoexpansus* Bykova, **41,** p. 19, pl. 1, fig. 6. Upper Cretaceous, Ferghana, USSR.

——— *quadriloculinus* Mjatliuk, **183,** p. 44, pl. 1, fig. 9. Neocomian, Middle Volga region, USSR.

——— *spirolinoides* Silvestri, **220,** p. 139, pl. 27, fig. 1. Ypresian, Somaliland.

——— *subaequalis* Mjatliuk, **183,** p. 44, pl. 2, figs. 19, 20. Neocomian, Middle Volga region, USSR.

Ammodiscus abbreviatus Ireland, **122,** p. 200, fig. B-32, B-33. Silurian, Oklahoma.

——— *exsertus* Cushman, 1910, var. *minutus* Ireland, **122,** p. 200, fig. B-20, B-21. Silurian, Oklahoma. (Note: The varietal designation is preoccupied by *Ammodiscus minutus* Paalzow, 1932, Ver. Vaterländ. Naturkunde Württemberg, Jahresber. und Verh., vol. 88, p. 93, pl. 4, figs. 10, 11, from the Argovian of Germany.)

——— *giganteus* Mjatliuk, **183,** p. 39, pl. 2, fig. 21. Upper Jurassic, Middle Volga region, USSR.

——— *minutissimus* Cushman and McCulloch, **66,** p. 70, pl. 5, figs. 3, 4. Recent, Pacific, off Peru, 18 fathoms.

Ammofrondicularia compressa Cushman and McCulloch, **66,** p. 68, pl. 4, figs. 7–13. Pacific, Recent, off Galapagos Islands, 32 fathoms.

Ammomarginulina arenacea Le Roy, **158,** p. 227, pl. 4, figs. 28, 29. Miocene, Central Sumatra.

Amphimorphina ignota Cushman and Siegfus, **69,** p. 27, pl. 6, figs. 10–13. Eocene, California.

Angulogerina hispidula Cushman and McGlamery, **67,** p. 47, pl. 9, fig. 6. Lower Oligocene, Alabama.

——— *mauricensis* Howe, **128,** p. 71, pl. 8, figs. 27, 28. Eocene, Cook Mountain formation, Louisiana.

Anomalina atlantis Bermudez, **28,** p. 250, pl. 33, figs. 6–8. Recent, Antillean region, 190 fathoms.

——— *garzaensis* Cushman and Siegfus, **69,** p. 32, pl. 7, fig. 3. Eocene, California.

Arenodosaria, gen. nov., Finlay, **96,** p. 95. Fam. *Valvulinidae.* Genotype: *Clavulina robusta* Stache, Novara Exped., Pal. Theil, vol. 1, p. 169, pl. 21, figs. 9, 10. Eocene to Miocene, ? Recent.

Arenosiphon, gen. nov., Grubbs, **106,** p. 544. Fam. *Rhizamminidae.* Genotype: *Arenosiphon gigantea* Grubbs, 1939. Silurian.

——— *gigantea* Grubbs, **106,** p. 544, pl. 61, figs. 1–3. Silurian, Chicago area.

Arenosphaera, gen. nov., Stschedrina, **228,** p. 95. Fam. *Stegnaminidae.* Genotype: *Arenosphaera perforata* Stschedrina, 1939. Arctic Seas. Benthonic.

——— *perforata* Stschedrina, **228,** p. 96, text figs. 1, 2. Recent, Arctic Seas (Kara Sea).

Asanoina, gen. nov., Finlay, **95,** p. 541. Fam. *Rotaliidae.* Genotype: *Rotaliatina globosa* Yabe and Asano, 1937, Geol. Soc. Japan, Jour., vol. 44, p. 326, text fig. 3. Pliocene.

Asterigerina alabamensis Cushman and Garrett, **64,** p. 86, pl. 15, fig. 11. Eocene, Alabama. (Note: The species name is preoccupied by *Asterigerina alabamensis* Cushman and McGlamery, 1938, U. S. Geol. Surv., Prof. Pap. 189-D, p. 111, pl. 28, fig. 5 from the Oligocene of Alabama.)

——— *wilcoxensis* Cushman and Garrett, **64,** p. 86, pl. 15, fig. 10. Eocene, Alabama.

——— *hadleyi* Howe and Roberts, **128,** p. 79, pl. 10, figs. 13, 14. Eocene, Cook Mountain formation, Louisiana.

Astrorhiza hancocki Cushman and McCulloch, **66,** p. 31, pl. 1, fig. 1. Recent, Pacific, off Lower California, Mexico, 30 fathoms.

Baggatella, gen. nov., Howe, **128,** p. 79. Fam. *Rotaliidae.* Genotype: *Baggatella inconspicua* Howe, 1939. Eocene, Louisiana.

——— *inconspicua* Howe, **128,** p. 79, pl. 9, figs. 15, 16. Eocene, Cook Mountain formation, Louisiana.

Baggina compressa Le Roy, **158,** p. 259, pl. 5, figs. 26–28. Miocene, Central Sumatra.

——— *inflata* Le Roy, **158,** p. 260, pl. 1, figs. 14–16. Miocene, Central Sumatra.

Barbourina, gen. nov., Bermudez, **25,** p. 9. Fam. *Verneuilinidae.* Genotype: *Barbourina atlantica* Bermudez, 1939. Recent, Cuba.

——— *atlantica* Bermudez, **25,** p. 10, pl. 1, figs. 1–4. Recent, off south coast of Cuba, 240 fathoms.

Bathysiphon curvus Moremann, 1930, var. *gracilis* Ireland, **122,** p. 192, text fig. A-13, A-14. Silurian, Oklahoma.

——— *rugosus* Ireland, **122,** p. 192, text figs. A-2, A-3. Devonian, Oklahoma.

Bifarina atlantisae Cushman, **58,** p. 65, pl. 11, fig. 10. Upper Eocene, submarine core, off eastern coast of North America.

——— *crenulata* Le Roy, **158,** p. 250, pl. 6, figs. 11, 12. Miocene, Central Sumatra.

——— *nuttalli* Cushman and Siegfus, **69,** p. 28, pl. 6, fig. 3. Eocene, California. [For: *Loxostomum applini* Nuttall, 1930 (non *Bolivina applini* Plummer, 1926), Jour. Paleont., vol. 4, p. 285, pl. 24, figs. 4, 5.]

——— *vicksburgensis* (Cushman, 1922) var. *monsouri* Garrett, **103,** p. 577, pl. 65, fig. 14. Oligo-Miocene, Texas.

Bifurcammina, gen. nov., Ireland, **122,** p. 201. Fam. *Ammodiscidae.* Genotype: *Bifurcammina bifurca* Ireland, 1939. Silurian.

——— *bifurca* Ireland, **122,** p. 201, text figs. B-38, B-39. Silurian, Oklahoma.

——— *conjuncta* Ireland, **122,** p. 202, text fig. B-36. Silurian, Oklahoma.

——— *parallela* Ireland, **122,** p. 202, text fig. B-37. Silurian, Oklahoma.

Bigenerina humblei Cushman and Ellisor, **63,** p. 3, pl. 1, fig. 4. Miocene, Louisiana.

——— *nodosaria* d'Orbigny, 1826, var. *directa* Cushman and Ellisor, **63,** p. 4, pl. 1, fig. 5. Miocene, Louisiana.

——— *reophaciformis* Ishizaki, **134,** p. 111, pl. 8, fig. 4; text fig. 2. Middle Miocene, Taiwan.

Bitubulogerina ellisi Howe, **128,** p. 69, pl. 8, figs. 36, 37. Eocene, Cook Mountain formation, Louisiana.

Bolivina atlantisae Cushman, **58,** p. 65, pl. 11, figs. 6, 7. Upper Eocene, submarine core, off eastern coast of North America.

——— *broussardi* Howe and Roberts, **126,** p. 65, pl. 9, figs. 7, 8. Eocene, Cook Mountain formation, Louisiana.

——— *costata* d'Orbigny, 1839, var. *dissimilis* Cushman and Ellisor, **63,** p. 6, pl. 1, fig. 10. Miocene, Louisiana.

——— *gesteri* Le Roy, **158,** p. 247, pl. 6, figs. 16, 17. Miocene, Central Sumatra.

——— *harangensis* Cushman and Ellisor, **63,** p. 6, pl. 1, fig. 9. Probably Miocene, Louisiana.

——— *huneri* Howe, **128,** p. 66, pl. 9, figs. 3, 4. Eocene, Cook Mountain formation, Louisiana.

——— *karamerica* Morozova, **185,** p. 75, pl. 2, fig. 3. Lower Eocene, Emba region, USSR.

——— *lapsus* Finlay, **96,** p. 98, pl. 11, fig. 9. Lower Miocene, New Zealand. [For: *Bolivina limbata* Chapman, 1926 (non Brady), New Zealand Geol. Surv., Pal. Bull., vol. 11, p. 40, pl. 9, fig. 6.]

——— *longicostata* Le Roy, **158,** p. 246, pl. 2, figs. 14–16. Miocene, Central Sumatra.

——— *louisiana* Howe, **128,** p. 66, pl. 9, figs. 20, 21. Eocene, Cook Mountain formation, Louisiana.
——— *marginoserrata* Le Roy, **158,** p. 247, pl. 4, figs. 8, 9. Miocene, Central Sumatra.
——— *mauricensis* Howe, **128,** p. 66, pl. 9, figs. 5, 6. Eocene, Cook Mountain formation, Louisiana.
——— *stuckeyi* Howe, **128,** p. 67, pl. 9, figs. 18, 19. Eocene, Cook Mountain formation, Louisiana.
——— *submarina* Cushman, **58,** p. 64, pl. 11, figs. 8, 9. Upper Eocene, submarine core, off eastern coast of North America.
——— *sumatrensis* Le Roy, **158,** p. 248, pl. 1, figs. 4, 5. Miocene, Central Sumatra.
——— *taylori* Howe, **128,** p. 67, pl. 9, figs. 9, 10. Eocene, Cook Mountain formation, Louisiana.
——— *tenuistriata* Cushman and Ellisor, **63,** p. 5, pl. 1, fig. 8. Oligocene, Louisiana.
——— *thomsoni* Howe, **128,** p. 68, pl. 9, fig. 17. Eocene, Cook Mountain formation, Louisiana.
——— *uniforminata* Le Roy, **158,** p. 248, pl. 4, figs. 10–13. Miocene, Central Sumatra.
Bolivinita quadrilatera (Schwager, 1866) var. *sumatrensis* Le Roy, **158,** p. 242, pl. 1, figs. 24–26. Miocene, Central Sumatra.
Bolivinopsis carinatiformis Morozova, **185,** p. 71, pl. 1, fig. 15. Cenomanian, Emba region, USSR.
Bulimina bortonica Finlay, **96,** p. 100, pl. 12, figs. 25, 26. Middle Eocene, New Zealand.
——— *macilenta* Cushman and Parker, **68,** p. 94. [Note: This is a *nomen novum* for *Bulimina denticulata* Cushman and Parker, 1936 (non *B. truncana* Gümbel, 1868, var. *denticulata* Protescu, 1932), in Contr. Cushman Lab. Foram. Research, vol. 12, p. 42, pl. 7, figs. 7, 8.]
——— *mauricensis* Howe, **128,** p. 62, pl. 8, figs. 29, 30. Eocene, Cook Mountain formation, Louisiana.
——— (?) *petalifera* Howe, **128,** p. 63, pl. 9, figs. 22, 23. Eocene, Cook Mountain formation, Louisiana.
——— *robertsi* Howe and Ellis, **128,** p. 63, pl. 8, figs. 32, 33. Eocene, Cook Mountain formation, Louisiana.
——— *truncana* Gümbel, 1868, var. *aksuatica* Morozova, **185,** p. 74, pl. 3, fig. 3. Eocene, Emba region, USSR.
——— *winniana* Howe, **128,** p. 64, pl. 8, fig. 31. Eocene, Cook Mountain formation, Louisiana.
Büningia, gen. nov., Finlay, **96,** p. 122. Fam. *Rotaliidae*. Genotype: *Büningia creeki* Finlay, 1939. Lower Miocene, New Zealand.
——— *creeki* Finlay, **96,** p. 123, pl. 14, figs. 82–84. Lower Miocene, New Zealand.

Camerina guayabalensis Barker, **22,** p. 325, pl. 13, fig. 4; pl. 18, fig. 4; pl. 22, fig. 3. Middle Eocene, Mexico.
——— *jacksonensis* Gravell and Hanna, 1935, var. *globosa* Barker, **22,** p. 324, pl. 13, figs. 1, 2; pl. 20, figs. 4, 5; pl. 22, figs. 5, 6. Upper Eocene, Mexico. (Note: The varietal name is preoccupied by *Nummulina globosa* Rütimeyer, 1850, Nouv. Mem. Soc. Helvet. Sci. Nat., vol. 11, no. 2, p. 77, pl. 3, figs. 21–24.)
——— *pellatispiroides* Barker, **22,** p. 325, pl. 20, fig. 10; pl. 22, fig. 4. Basal Eocene, Mexico.
Cancris claibornensis Howe, **128,** p. 78, pl. 10, figs. 20, 21. Eocene, Cook Mountain formation, Louisiana.
Cassidulina arata Finlay, **96,** p. 112, pl. 14, figs. 74, 75. Lower Miocene, New Zealand.
——— *laticamerata* Voloshinova, **262,** p. 84, pl. 2, fig. 6. Pliocene, Kamchatka.
——— *winniana* Howe, **128,** p. 82, pl. 11, figs. 7, 8. Eocene, Cook Mountain formation, Louisiana.
Ceratammina, gen. nov., Ireland, **122,** p. 194. Fam. *Saccamminidae*. Genotype: *Ceratammina cornucopia* Ireland, 1939. Devonian.
——— *cornucopia* Ireland, **122,** p. 196, text figs. A-31, A-32. Devonian, Oklahoma.
Ceratobulimina (*Ceratocancris*) *clifdenensis* Finlay, **96,** p. 117, pl. 13, fig. 62. Lower Miocene, New Zealand.
——— (*Ceratobulimina*) *kellumi* Finlay, **96,** p. 115, pl. 13, fig. 60. Lower Miocene, New Zealand.
——— (———) *lornensis* Finlay, **96,** p. 116, pl. 13, fig. 61. Lower Oligocene, New Zealand.
Ceratocancris, subgen. nov. Finlay, **96,** p. 117. Subgenus of *Ceratobulimina* Toula, 1915. Fam. *Robertinidae* Finlay, 1939. Subgenotype: *Ceratobulimina* (*Ceratocancris*) *clifdenensis* Finlay, 1939. Lower Miocene.
Cerobertina, gen. nov., Finlay, **96,** p. 118. Fam. *Robertinidae* Finlay, 1939. Genotype: *Cerobertina batrumi* Finlay, 1939. Eocene to Miocene, Recent, Pacific.
——— *batrumi* Finlay, **96,** p. 118, pl. 11, figs. 2, 3. Lower Miocene, New Zealand.
——— *crepidula* Finlay, **96,** p. 121, pl. 11, fig. 1. Lower Miocene, New Zealand.
——— *kakahoica* Finlay, **96,** p. 120, pl. 13, fig. 59. Middle Eocene, New Zealand.
——— *mahoenvica* Finlay, **96,** p. 119, pl. 13, fig. 58. Lower Miocene, New Zealand.
Chitinodendron franconianum Ruedemann and Shrock, **201,** p. 66, text figs. 1–3. Upper Cambrian, Wisconsin.
Cibicides artemi Bykova, **41,** p. 31, pl. 4, figs. 1–3. Upper Cretaceous, Ferghana, USSR.
——— *carstensi* Cushman and Ellisor, **63,** p. 13, pl. 2, fig. 8. Miocene, Louisiana.
——— ——— ——— ——— var. *opima* Cushman and Ellisor, **63,** p. 14, pl. 2, fig. 7. Miocene, Louisiana.
——— *dorsopustulosus* Le Roy, **158,** p. 268, pl. 1, figs. 1–3. Miocene, Central Sumatra.
——— *foxi* Le Roy, **158,** p. 268, pl. 9, figs. 8–10. Miocene, Central Sumatra.
——— *hazzardi* Ellis, **85,** p. 424, pl. 48, figs. 8, 9. Oligo-Miocene, Texas.
——— *jeffersonensis* Garrett, **103,** p. 579, pl. 66, fig. 10. Oligo-Miocene, Texas.
——— *koeboeensis* Le Roy, **158,** p. 268, pl. 7, figs. 13–15. Miocene, Central Sumatra.
——— *mauricensis* Howe and Roberts, **128,** p. 87, pl. 13, figs. 4, 5. Eocene, Cook Mountain formation, Louisiana.
——— *moreyi* Garrett, **103,** p. 579, pl. 66, fig. 9. Oligo-Miocene, Texas.

——— *lawi* Howe, **128,** p. 87, pl. 13, figs. 12–14. Eocene, Cook Mountain formation, Louisiana.
——— *mundus* Bykova, **41,** p. 32, pl. 2, figs. 4–6. Upper Cretaceous, Ferghana, USSR.
——— *parki* Finlay, **94,** p. 528, pl. 69, fig. 1. Upper Eocene, New Zealand.
——— *rokanensis* Le Roy, **158,** p. 269, pl. 4, figs. 25–27. Miocene, Central Sumatra.
——— *subbotinae* Bykova, **41,** p. 33, pl. 4, figs. 7–9. Upper Cretaceous, Ferghana, USSR.
——— *tapanoeliensis* Le Roy, **158,** p. 270, pl. 7, figs. 18–20. Miocene, Central Sumatra.
——— *tapoengensis* Le Roy, **158,** p. 269, pl. 6, figs. 6–8. Miocene, Central Sumatra.
——— *telisaensis* Le Roy, **158,** p. 271, pl. 8, figs. 16–18. Miocene, Central Sumatra.
——— *tholus* Finlay, **96,** p. 122, pl. 12, figs. 34, 35. Middle Eocene, New Zealand.
——— *vialovi* Bykova, **41,** p. 31, pl. 4, figs. 13–15. Upper Cretaceous, Ferghana, USSR.
——— *westi* Howe, **128,** p. 88, pl. 13, figs. 20–22. Eocene, Cook Mountain formation, Louisiana.
Clavulina subangularis Ishizaki, **134,** p. 112, pl. 8, fig. 8; text fig. 3. Middle Miocene, Taiwan.
Clavulinoides instar Finlay, **96,** p. 94, pl. 14, fig. 77. Middle Miocene, New Zealand.
——— *olssoni* Finlay, **96,** p. 93, pl. 14, fig. 76. Lower Miocene, New Zealand.
——— *virilis* Finlay, **96,** p. 94, pl. 14, fig. 78. Middle Oligocene, New Zealand.
Coskinolina schuberti Silvestri, **220,** p. 143, pl. 19, fig. 4. Lower Lutetian, Somaliland.
Cribrogoesella pacifica Cushman and McCulloch, **66,** p. 99, pl. 10, figs. 10–12. Recent, Pacific, off Guadelupe Island, 250 fathoms.
Cribrolinoides, gen. nov., Cushman and Le Roy, **65,** p. 17. Fam. *Miliolidae.* Genotype: *Quinqueloculina disparilis* d'Orbigny, 1826, var. *curta* Cushman, 1917, U. S. Nat. Mus., Bull. 71, part 6, p. 49, pl. 14, fig. 2; text fig. 30, Recent, Philippine Islands. Pliocene, Java; Recent, Indopacific.
Cristellaria aquilonica Mjatliuk, **183,** p. 53, pl. 3, fig. 35. Upper Jurassic, Middle Volga region, USSR.
——— *batrakiensis* Mjatliuk, **183,** p. 61, pl. 4, figs. 52, 53. Upper Jurassic, Middle Volga region, USSR.
——— *biexcavata* Mjatliuk, **183,** p. 56, pl. 4, figs. 41, 42. Upper Jurassic, Middle Volga region, USSR.
——— *brückmanni* Mjatliuk, **183,** p. 59, pl. 4, figs. 48, 49. Upper Jurassic, Middle Volga region, USSR.
——— *calloviensis* Mjatliuk, **183,** p. 60, pl. 4, fig. 51. Upper Jurassic, Middle Volga region, USSR.
——— *hyalina* Mjatliuk, **183,** p. 55, pl. 3, fig. 37. Upper Jurassic, Middle Volga region, USSR.
——— *infravolgensis* Furssenko, in Mjatliuk, **183,** p. 55, pl. 3, figs. 38, 39. Upper Jurassic, Middle Volga region, USSR.
——— *kaschpurica* Mjatliuk, **183,** p. 56, pl. 4, fig. 40. Upper Jurassic, Middle Volga region, USSR.
——— *magna* Mjatliuk, **183,** p. 52, pl. 3, figs. 32, 34. Upper Jurassic, Middle Volga region, USSR. (Note: This species is preoccupied by *Cristellaria magna* Costa, 1856, Atti Accad. Pont. Napoli, vol. 7, p. 19, text figs. 2a, b.)
——— *russiensis* Mjatliuk, **183,** p. 58, pl. 4, figs. 44–46. Upper Jurassic, Middle Volga region, USSR.
——— *uralica* Mjatliuk, **183,** p. 51, pl. 3, figs. 30, 31. Upper Jurassic, Middle Volga region, USSR.
——— *wisniowskii* Mjatliuk, **183,** p. 57, pl. 4, fig. 43. Upper Jurassic, Middle Volga region, USSR.
Cyclammina minima Le Roy, **158,** p. 228, pl. 9, figs. 15, 16. Miocene, Central Sumatra.
——— *praecancellata* Voloshinova, **262,** p. 82, pl. 3, figs. 1, 2. Upper Miocene-Lower Pliocene, Sakhalin, USSR.

Darbyella wilcoxensis Cushman and Garrett, **64,** p. 79, pl. 13, figs. 11, 12. Eocene, Alabama.
Dentalina doemaiensis Le Roy, **158,** p. 234, pl. 3, fig. 12. Miocene, Central Sumatra.
——— *granulostriata* Howe, **128,** p. 44, pl. 6, fig. 1. Eocene, Cook Mountain formation, Louisiana.
——— *hexacostata* Howe, **128,** p. 44, pl. 5, fig. 13. Eocene, Cook Mountain formation, Louisiana.
——— *hispido-costata* Cushman and Siegfus, **69,** p. 25, pl. 6, figs. 4, 5. Eocene, California.
——— *mauricensis* Howe and Roberts, **128,** p. 45, pl. 5, fig. 15. Eocene, Cook Mountain formation, Louisiana.
——— *nasuta* Cushman, **58,** p. 57, pl. 10, figs. 10, 11. Upper Eocene, submarine core, off eastern coast of North America.
——— *natchitochensis* Howe, **128,** p. 45, pl. 6, fig. 6. Eocene, Cook Mountain formation, Louisiana.
——— *pseudoinvolvens* Cushman and McGlamery, **67,** p. 45, pl. 9, figs. 1, 2. Lower Oligocene, Alabama.
——— *winniana* Howe, **128,** p. 45, pl. 5, fig. 17. Eocene, Cook Mountain formation, Louisiana.
Dentostomina aguayoi Perez Infante, **192,** p. 318, pl. 45, figs. 4–6. Recent, off Cuba.
——— *bermudezi* Perez Infante, **192,** p. 319, pl. 45, figs. 7–9. Recent, off Cuba.
——— *bermudiana* Carmann, 1933, var. *trilongidens* Perez Infante, **192,** p. 318, pl. 45, figs. 1–3. Recent, off Cuba.
Dictyoconus arietinus Silvestri, **220,** p. 154, pl. 19, figs. 3, 5, 8, 10. Lutetian, Somaliland.
——— *daviesi* Silvestri, **220,** p. 148, pl. 13, figs. 5, 6, 10; pl. 17, fig. 7. Lower Lutetian, Somaliland.
——— *gracilis* Silvestri, **220,** p. 155, pl. 19, fig. 1. Lutetian, Somaliland.
Discorbis ferganensis Bykova, **41,** p. 28, pl. 3, figs. 7–9. Upper Cretaceous, Ferghana, USSR.
——— *gravelli* Garrett, **103,** p. 578, pl. 66, figs. 2, 3. Oligo-Miocene, Texas.
——— *huneri* Howe, **128,** p. 74, pl. 9, figs. 26, 27. Eocene, Cook Mountain formation, Louisiana.
——— *janus* Voloshinova, **262,** p. 84, pl. 2, figs. 3, 4. Pliocene, Kamchatka, USSR.
——— *mauricensis* Howe and Roberts, **128,** p. 74, pl. 9, figs. 28–30. Eocene, Cook Mountain formation, Louisiana.

——— *nomada* Garrett, **103,** p. 578, pl. 66, fig. 4. Oligo-Miocene, Texas.
——— *rukasi* Howe, **128,** p. 74, pl. 10, figs. 25, 26. Eocene, Cook Mountain formation, Louisiana.
——— *subaraucana* Cushman, 1922, var. *dissona* Cushman and Ellisor, **63,** p. 10, pl. 2, fig. 2. Oligocene, Louisiana.
——— *subpatelliformis* Cushman and McGlamery, **67,** p. 48, pl. 9, fig. 8. Lower Oligocene, Alabama. [For: *Discorbis patelliformis* Cushman, 1923 (non Brady, 1884), U. S. Geol. Surv., Prof. Pap. 133, p. 38, pl. 6, figs. 2–4.]
——— *vescus* Bykova, **41,** p. 28, pl. 3, figs. 1–6. Upper Cretaceous, Ferghana, USSR.

Ellipsoglandulina antillea Bermudez, **28,** p. 247, pl. 33, figs. 1, 2. Recent, Antillean region, 810 fathoms.
Ellipsolagena (?) mauricensis Howe and Roberts, **128,** p. 72, pl. 9, figs. 12, 13. Eocene, Cook Mountain formation, Louisiana.
Ellipsonodosaria atlantisae Cushman, **58,** p. 70, pl. 12, figs. 3, 4. Upper Eocene, submarine core, off eastern coast of North America.
——— ——— ——— var. *hispidula* Cushman, **58,** p. 70, pl. 12, fig. 5. Upper Eocene, submarine core, off eastern coast of North America.
——— *curvatura* Cushman, **58,** p. 71, pl. 12, fig. 6. Upper Eocene, submarine core, off eastern coast of North America.
——— ——— ——— var. *spinea* Cushman, **58,** p. 71, pl. 12, figs. 7–11. Upper Eocene, submarine core, off eastern coast of North America.
——— *semijugosa* Cushman, **58,** p. 69, pl. 12, figs. 1, 2. Upper Eocene, submarine core, off eastern coast of North America.
Elphidium glabratum Cushman, **54,** p. 74, pl. 12, fig. 16. Miocene, France.
——— *hampdenensis* Finlay, **96,** not described, only figured on pl. 12, figs. 29, 30. Middle Eocene, New Zealand.
——— *hughesi* Cushman and Grant, 1927, var. *foraminosum* Cushman, **54,** p. 49, pl. 13, fig. 8. Pliocene, California. (For: *Elphidium hughesi* Cushman and Grant, *var.*, 1927, San Diego Soc. Nat. Hist., Trans., vol. 15, no. 6, p. 76, pl. 7, fig. 5.)
——— ——— ——— ——— var. *obesum* Cushman, **54,** p. 49, pl. 13, fig. 9. Pliocene, California. (For: *Elphidium hughesi* Cushman and Grant, *var.*, 1927, San Diego Soc. Nat. Hist., Trans., vol. 15, no. 6, p. 75, pl. 7, fig. 4.)
——— *icenorum* Macfadyen, **166,** p. 610, pl. 15, figs. a, b. Subrecent, 2500 B.C. to 1000 A.D. Brackish water.
——— *incertum* (Williamson) var. *obscura* Voloshinova, **263,** p. 16, pl. 1, figs. 9, 10. Recent, Arctic, Okhotsk Sea, USSR.
——— *koeboeense* Le Roy, **158,** p. 240, pl. 9, figs. 6, 7. Miocene, Central Sumatra.
——— *orientale* Voloshinova, **262,** p. 83, pl. 2, fig. 1. Pliocene, Kamchatka, USSR.
——— *rischtanicum* Bykova, **41,** p. 27, pl. 3, figs. 10–12. Upper Cretaceous, Ferghana, USSR.
——— ——— ——— var. *ferganensis* Bykova, **41,** p. 27, pl. 3, figs. 13, 14. Upper Cretaceous, Ferghana, USSR.
——— *rolshauseni* Cushman and Ellisor, **63,** p. 4, pl. 1, fig. 7. Miocene, Louisiana.
——— *rota* Ellis, **85,** p. 424, pl. 48, figs. 6, 7. Oligo-Miocene, Mississippi.
——— *sachalinense* Voloshinova, **262,** p. 83, pl. 2, fig. 2. Mio-Pliocene, Sakhalin, USSR.
——— *saginatum* Finlay, **96,** not described, only figured on pl. 12, figs. 31–33. Middle Eocene, New Zealand.
Eolepidina, subgen. nov., Tan, **237,** p. 65, 69. Fam. *Orbitoididae*, subfam. *Lepidocyclininae*. Subgenus of *Lepidocyclina*. Subgenotype: *Eulinderina semiradiata* Barker and Grimsdale, 1936. Jour. Paleont., vol. 10, p. 238, pl. 30, figs. 10–12; pl. 32, figs. 15–17; pl. 35, figs. 1–3; pl. 37, fig. 1, emend. by Tan, 1936, Nat. Tijdschr. Nederl.-Indië, vol. 96, p. 246. Lower and Middle Eocene, Mexico.
Eponides ellisorae Garrett, **103,** p. 459, pl. 66, figs. 6–8. Oligo-Miocene, Texas.
——— *lornensis* Finlay, **94,** p. 522. Onomatype. Lower Oligocene, New Zealand.

Fascispira, gen. nov., Silvestri, **221,** p. 230. Fam. *Peneroplidae*. Genotype: *Fascispira colomi* Silvestri, 1939. Upper Cretaceous.
——— *colomi* Silvestri, **221,** p. 230, pl. 12, figs. 1–9. Upper Cretaceous, Spain.
Flabellammina (Frankeina?) jurassica Mjatliuk, **183,** p. 47, pl. 2, fig. 22. Upper Jurassic, Middle Volga region, USSR.
Flintina clenchi Bermudez, **27,** p. 199, pl. 30, figs. 1–5. Recent, Dominican Republic.
Frankeina elegans Mjatliuk, **183,** p. 48, pl. 2, fig. 26. Upper Jurassic, Middle Volga region, USSR.
Frondicularia applanata Wick, **271,** p. 496, pl. 20, fig. 7. Upper Oligocene, Germany.
——— ——— ——— var. *gigas* Wick, **271,** p. 496, pl. 23, fig. 12. Upper Miocene, Germany. (Note: The varietal name is preoccupied by *Frondicularia gigas* Church, 1929, Jour. Paleont., vol. 3, p. 303, text figs. 1, 2. Recent, California.)
——— *jarvisi* Cushman, **59,** p. 91, pl. 16, fig. 6. Cretaceous, Trinidad. [For: *Frondicularia archiaciana* Cushman, 1926 (non d'Orbigny, 1840), Contr. Cushman Lab. Foram. Res., vol. 2, p. 21, pl. 3, fig. 4; for: *Frondicularia sp. (?)* Cushman, 1926, Bull. Amer. Assoc. Petrol. Geologists, vol. 10, p. 598, pl. 20, fig. 2; for: *Frondicularia elongata* Cushman and Jarvis, 1928 (non Olszewski, 1875, nec Costa, 1855, nec White, 1928) in Contr. Cushman Lab. Foram. Res., vol. 4, p. 98, pl. 14, fig. 1, and in Cushman and Jarvis, 1932, Proc. U. S. Nat. Mus., vol. 80, Art. 14, p. 39, pl. 12, fig. 3.)
——— *levis* Wick, **271,** p. 496, pl. 20, fig. 13 Upper Miocene, Germany. (Note: This species is preoccupied by *Frondicularia laevis* Marsson, 1878, Mitth. Nat. Ver. Neu-Vorpommern and Rügen, vol. 10, p. 136, pl. 2, fig. 16 from the Upper Cretaceous of Rügen.)

Gaudryina asiatica Bykova, **41,** p. 20, pl. 1, figs. 15, 16; text fig. 2. Upper Cretaceous, Ferghana, USSR.
——— (*Pseudogaudryina*) *atlantica* (Bailey, 1851) var. *pacifica* Cushman and McCulloch, **66,** p. 94, pl. 9, figs. 1, 2. Recent, Pacific, off San Benito Island, 121 fathoms.
——— *fenestrata* Finlay, **96,** p. 92, pl. 14, fig. 68. Lower Miocene, New Zealand.
——— *geometrica* Howe, 128, p. 33, pl. 2, figs. 6, 7. Eocene, Cook Mountain formation, Louisiana.
——— (*Pseudogaudryina*) *proreussi* Finlay, **94,** p. 511. Only described, but not figured. Middle Eocene, New Zealand.
——— *subglabrata* Cushman and McCulloch, **66,** p. 92, pl. 8, figs. 5–7. Recent, Pacific, off coast of California, 7 fathoms. (Note: cave *Gaudryina subglabra* Gümbel, 1868.)
——— ——— ——— ——— *var.*, Cushman and McCulloch, **66,** p. 93, pl. 8, fig. 8. Recent, Pacific.
Gladiaria, gen. nov., Wick, **271,** p. 479, from Lower Oligocene of Germany. [(Note: This new genus is apparently identical with *Gladiaria* Wedekind, 1937 (see Jour. Paleont., vol. 15, 1941, p. 652 for reference). Wick has, however, chosen another genotype: *Cristellaria hermanni* Andreae, 1897, Mitt. geol. Landes-Anst. Elsass-Lothr., vol. 4, p. 298, text fig., while Wedekind mentioned *Cristellaria decorata* Reuss, 1855, as genotype.]
——— *multilimbosa* Wick, **271,** p. 488, pl. 21, fig. 7. Middle Miocene, Germany.
Glandulina kalimnensis Parr, **190,** p. 67, pl. 1, figs. 5, 6. Pliocene, southeastern Australia.
Globigerina baroemoenensis Le Roy, **158,** p. 263, pl. 6, figs. 1, 2. Miocene, Central Sumatra.
——— *linaperta* Finlay, **96,** p. 125, pl. 13, figs. 54–57. Middle Eocene, New Zealand.
——— ——— ——— var. *turgida* Finlay, **96,** p. 125, only described, not figured. Middle Eocene, New Zealand.
——— *siakensis* Le Roy, **158,** p. 262, pl. 4, figs. 20–22. Miocene. Central Sumatra.
Globigerinoides index Finlay, **96,** p. 125, pl. 14, figs. 85–88. Middle Eocene, New Zealand.
——— *sacculiferus* (Brady, 1877) var. *immatura* Le Roy, **158,** p. 263, pl. 3, figs. 19–21. Miocene, Central Sumatra.
Globorotalia barisanensis Le Roy, **158,** p. 265, pl. 1, figs. 8–10. Miocene, Central Sumatra.
——— *crater* Finlay, **96,** p. 125, not figured, only described. Middle Eocene, New Zealand.
——— *fohsi* Cushman and Ellisor, **63,** p. 12, pl. 2, fig. 6. Miocene, Louisiana.
——— *inconspicua* Howe, **128,** p. 85, pl. 12, figs. 20–22. Eocene, Cook Mountain formation, Louisiana.
——— *mayeri* Cushman and Ellisor, **63,** p. 11, pl. 2, fig. 4. Miocene, Louisiana.
——— *quadrata* Cushman and Ellisor, **63,** p. 11, pl. 2, fig. 5. Miocene, Louisiana.
——— *pseudoscitula* Glaessner, 1937, mut. *prima* Morozova, **185,** p. 81, pl. 2, figs. 6–8. Lower Eocene, Emba region, USSR.
——— *subbotinae* Morozova, **185,** p. 80, pl. 2, figs. 16, 17. Paleocene, Emba region, USSR.
Globulina alabamensis Cushman and McGlamery, **67,** p. 46, pl. 9, fig. 3. Lower Oligocene, Alabama. [For: *Polymorphina spinosa* Cushman, 1922 (non *Globulina spinosa* d'Orbigny, 1846), U. S. Geol. Surv., Prof. Pap. 129-F, p. 133, pl. 31, fig. 5.]
Glomospira siluriana Ireland, **122,** p. 201, text figs. B-27, B-28. Silurian, Oklahoma.
——— *westgatei* Ireland, **122,** p. 200, text figs. B-25, B-26. Silurian, Oklahoma.
Goësella parva Cushman and McCulloch, **66,** p. 98, pl. 10, figs. 13, 14. Recent, Pacific, off coast of Mexico, 19 fathoms.
Gümbelina garretti Howe, **128,** p. 61, pl. 8, fig. 14. Eocene, Cook Mountain formation, Louisiana.
——— *mauriciana* Howe and Roberts, **128,** p. 62, pl. 8, figs. 9–11. Eocene, Cook Mountain formation, Louisiana.
Gümbelitria columbiana Howe, **128,** p. 62, pl. 8, figs. 12, 13. Eocene, Cook Mountain formation, Louisiana.
Gyroidina conica Wick, **271,** p. 508, pl. 18, fig. 21. Lower Oligocene, Germany.
——— *vicksburgensis* (Cushman, 1922) var. *hannai* Garrett, **103,** p. 578, pl. 66, fig. 5. Oligo-Miocene, Texas.

Hantkenina australis Finlay, **95,** p. 538, pl. 69, fig. 5. Upper Middle Eocene, New Zealand.
Haplophragmoides barremicus Mjatliuk, **183,** p. 43, pl. 1, fig. 8. Lower Cretaceous, Middle Volga region, USSR.
——— *columbiense* Cushman, 1925, var. *evolutum* Cushman and McCulloch, **66,** p. 73, pl. 5, figs. 11, 12; pl. 6, figs. 1, 2. Recent, Pacific, off Lower California, Mexico, 82 fathoms. (Note: The varietal name is preoccupied by *Haplophragmoides evoluta* Natland, 1938, Bull. Scripps Inst. Oceanogr., Tech. series, vol. 4, p. 138, pl. 3, figs. 5, 6. Recent, west coast of North America.)
——— *compressa* Le Roy, **158,** p. 227, pl. 5, figs. 24, 25. Miocene, Central Sumatra.
——— *hancocki* Cushman and McCulloch, **66,** p. 79, pl. 6, figs. 5, 6. Recent, Pacific, off Alaska, 7 fathoms. [For: *Haplophragmoides advena* Cushman and Valentine, 1930 (non Cushman, 1925), Contr. Dept. Geol. Stanford Univ., vol. 1, no. 1, p. 7, pl. 1, fig. 5.]
——— *laciniosus* Bykova, **41,** p. 17, pl. 1, figs. 4, 5. Upper Cretaceous, Ferghana, USSR.
——— *mauricensis* Howe and Ellis, **128,** p. 30, pl. 1, figs. 3–5. Eocene, Cook Mountain formation, Louisiana.
——— *miser* Bykova, **41,** p. 17, pl. 1, figs. 13, 14. Upper Cretaceous, Ferghana, USSR.
——— *subinvolutum* Cushman and McCulloch, **66,** p. 83, pl. 7, figs. 3–5. Recent, Pacific, off Oregon coast, U.S.A.
——— *veleronis* Cushman and McCulloch, **66,** p. 82, pl. 7, fig. 2. Pacific, Recent, off Guadalupe Island, 250 fathoms.
——— *volgensis* Mjatliuk, **183,** p. 42, pl. 1, fig. 6. Upper Jurassic, Middle Volga region, USSR.
Hauerina simplex Silvestri, **220,** p. 93, pl. 11, fig. 1; pl. 12, fig. 6. Ypresian, Somaliland.
Hopkinsina bortotara Finlay, **96,** p. 104, pl. 12, figs. 22–24. Upper Eocene, New Zealand.

——— *notohispida* Finlay, **96,** p. 105, pl. 12, fig. 10, 11. Upper Miocene, New Zealand.
——— *wanzea* Finlay, **96,** p. 104, pl. 12, figs. 20, 21. Middle Eocene, New Zealand.
Hyperammina harrisi Ireland, **122,** p. 200, text fig. A-26. Silurian, Oklahoma.

Karreriella mauricensis Howe and Ellis, **128,** p. 34, pl. 2, figs. 1, 2. Eocene, Cook Mountain formation, Louisiana.

Lagena aequabilis Matthes, **179,** p. 89, pl. 8, fig. 148. Miocene, Austria.
——— *albopunctata* Matthes, **179,** p. 75, pl. 5, fig. 79. Miocene, Austria.
——— *aperta* Matthes, **179,** p. 66, pl. 4, figs. 38, 39. Miocene, Austria. [For: *Lagena botelliformis* Sidebottom, 1912 (non Brady, 1884), Jour. Quekett Micr. Club, vol. 40, pl. 14, figs. 24–29.]
——— *aspera* Reuss, 1861, var. *umbata* Matthes, **179,** p. 66, pl. 4, fig. 37. Middle Oligocene, Germany.
——— *axiformis* Matthes, **179,** p. 64, pl. 4, figs. 32–34. Middle Oligocene, Germany.
——— *bella* Matthes, **179,** p. 71, pl. 4, fig. 60. Miocene, Austria.
——— *bellissima* Matthes, **179,** p. 72, pl. 5, fig. 65. Miocene, Germany.
——— *bicarinata* (Terquem, 1882) var. *polita* Matthes, **179,** p. 71, pl. 4, fig. 62. Miocene, Germany. (Note: This variety is preoccupied by *Lagena fimbriata* Brady var. *polita* Chapman and Parr, 1937, Australasian Antarctic Exped., 1911–14, Sci. Repts., series C, vol. 1, p. 66, pl. 7, fig. 8.)
——— ——— ——— var. *rara* Matthes, **179,** p. 72, pl. 5, fig. 63. Miocene, Germany.
——— *botula* Matthes, **179,** p. 65, pl. 4, fig. 36. Miocene, Germany.
——— *buchneri* Matthes, **179,** p. 79, pl. 6, fig. 100. Miocene, Austria.
——— *castrensis* Schwager, 1866, var. *plagata* Matthes, **179,** p. 76, pl. 5, fig. 83. Miocene, Germany.
——— *convexa* Matthes, **179,** p. 81, pl. 6, figs. 107, 108. Miocene, Germany. (For: *Entosolenia marginata* Williamson, 1858, Rec. Foram. Gt. Britain, pl. 1, figs. 19, 20.)
——— *convoluta* Matthes, **179,** p. 85, pl. 7, fig. 125. Miocene, Germany.
——— *crassicollata* Matthes, **179,** p. 90, pl. 8, fig. 155. Middle Oligocene, Germany.
——— *crebra* Matthes, **179,** p. 72, pl. 5, figs. 66–70. Miocene, Germany. [For, *Lagena acuta* Brady, 1884 (non Reuss), Challenger Exped., vol. 9, pl. 59, fig. 6.]
——— ——— ——— var. *abnormis* Matthes, **179,** p. 74, pl. 5, fig. 76. Oligocene, Germany.
——— *difissa* Matthes, **179,** p. 85, pl. 7, fig. 127. Miocene, Austria.
——— *distincta* Matthes, **179,** p. 76. Not described and not figured. [For: *Lagena radiata* Rhumbler, 1911, Foram. Plankton-Exped., vol. 1, pl. 22, fig. 17 (non fig. 16).]
——— ——— ——— var. *arborea* Matthes, **179,** p. 76, pl. 5, fig. 84. Lower Oligocene, Germany.
——— *elegantissima* (Bornemann, 1855) var. *furcata* Matthes, **179,** p. 58, pl. 3, fig. 15. Miocene, Germany.
——— *fenestrissima* Howe and Ellis, **128,** p. 50, pl. 6, fig. 18. Eocene, Cook Mountain formation, Louisiana.
——— *fibulata* Matthes, **179,** p. 76, pl. 5, fig. 85. Miocene, Austria.
——— *fissurata* Matthes, **179,** p. 87, pl. 7, fig. 141. Miocene, Austria.
——— *foraminata* Matthes, **179,** p. 81, pl. 6, fig. 110. Miocene, Germany.
——— ——— ——— var. *verrucosa* Matthes, **179,** p. 81, pl. 6, fig. 111. Miocene, Moravia.
——— *fragilis* Matthes, **179,** p. 89, pl. 8, fig. 150. Miocene, Germany.
——— *glaber* Matthes, **179,** p. 87, pl. 8, fig. 142. Miocene, Germany.
——— *heinzi* Matthes, **179,** p. 91, pl. 8, fig. 156. Miocene, Germany.
——— *hispida* Reuss, 1858, var. *crispata* Matthes, **179,** p. 61, pl. 3, fig. 21. Miocene, Germany.
——— *hystrix* Reuss, 1862, var. *longicolla* Matthes, **179,** p. 59, pl. 3, fig. 17. Miocene, Germany.
——— *laqueata* Matthes, **179,** p. 74, pl. 5, fig. 78. Miocene, Austria.
——— *limbata* Matthes, **179,** p. 81, pl. 6, fig. 112. Middle Oligocene, Germany.
——— ——— ——— var. *fistulosa* Matthes, **179,** p. 82, pl. 6, fig. 114. Miocene, Austria.
——— ——— ——— var. *semilimbata* Matthes, **179,** p. 82, pl. 6, fig. 113. Middle Oligocene, Germany.
——— *linguata* Matthes, **179,** p. 91, pl. 8, fig. 159. Miocene, Germany.
——— ——— ——— var. *sejuncta* Matthes, **179,** p. 91, pl. 8, fig. 160. Miocene, Austria.
——— *lunata* Matthes, **179,** p. 90, pl. 8, figs. 153, 154. Miocene, Germany.
——— *magnifica* Matthes, **179,** p. 70, pl. 4, figs. 50, 51. Middle Oligocene, Germany. [Note: This species is preoccupied by *Lagena magnifica* Sidebottom, 1912, Jour. Quekett Micr. Club (2), vol. 11, p. 425, pl. 21, fig. 8.]
——— *marginata* (Walker and Boys, 1784) var. *bidentata* Matthes, **179,** p. 83, pl. 6, fig. 118. Miocene, Austria.
——— ——— ——— ——— var. *incomposita* Matthes, **179,** p. 84, pl. 7, fig. 122. Miocene, Austria.
——— ——— ——— ——— var. *sexangulata* Matthes, **179,** p. 83, pl. 7, fig. 119. Miocene, Germany.
——— ——— ——— ——— var. *valida* Matthes, **179.** p. 84, pl. 7, figs. 120, 121. Miocene, Germany. (For: *Ellipsolagena dorbignyi* Wiesner, 1931, Deutsche Südpolar-Exped., vol. 20, Zool., p. 127, pl. 24, fig. p.)
——— *mauricensis* Howe and Ellis, **128,** p. 51, pl. 6, fig. 13. Eocene, Cook Mountain formation, Louisiana.
——— *minuta* Matthes, **179,** p. 69, pl. 4, fig. 49. Middle Oligocene, Germany.
——— *mirabilis* Matthes, **179,** p. 78, pl. 5, fig. 89. Middle Oligocene, Germany.
——— *modesta* Matthes, **179,** p. 85, pl. 7, fig. 128. Miocene, Austria. [For: *Fissurina alata* Reuss, 1870 (non Reuss, 1851), Sitzber. k. Akad. Wiss. Wien, vol. 52, pl. 5, figs. 19–21.]

——— ——— ——— var. *inducta* Matthes, **179,** p. 87, pl. 7, figs. 136–140. Middle Oligocene, Germany.
——— ——— ——— var. *stolata* Matthes, **179,** p. 86, pl. 7, fig. 133. Miocene, Germany.
——— ——— ——— var. *vasta* Matthes, **179,** p. 86, pl. 7, fig. 132. Miocene, Germany.
——— *ollulata* Matthes, **179,** p. 91, pl. 8, fig. 158. Middle Oligocene, Germany.
——— *opima* Matthes, **179,** p. 85, pl. 7, fig. 126. Miocene, Germany.
——— *orbignyana* (Seguenza, 1862) var. *nuda* Matthes, **179,** p. 81, pl. 6, fig. 106. Miocene, Germany. [Note: This variety is preoccupied by *Lagena lagenoides* (Williamson, 1858), var. *nuda* Chapman, 1909, New Zealand Philos. Inst. Canterbury, vol. 1, p. 338, pl. 15, fig. 9.]
——— ——— ——— var. *pileata* Matthes, **179,** p. 80, pl. 6, fig. 105. Middle Oligocene, Germany.
——— *partimbicincta* Matthes, **179,** p. 71, pl. 4, figs. 58, 59. Miocene, Germany.
——— *patellata* Matthes, **179,** p. 84, pl. 7, fig. 123. Miocene, Germany. [For: *Lagena marginata* Sidebottom, 1912 (non Walker and Boys, 1784), Jour. Quekett Micr. Club, vol. 40, pl. 17, fig. 30.]
——— ——— ——— var. *sinsera* Matthes, **179,** p. 85, pl. 7, fig. 124. Miocene, Austria.
——— *plana* Matthes, **179,** p. 69, pl. 4, fig. 47. Miocene, Austria.
——— *planata* Matthes, **179,** p. 70, pl. 4, figs. 52, 53. Miocene, Austria.
——— ——— ——— var. *ansata* Matthes, **179,** p. 70, pl. 4, fig. 54. Miocene, Germany.
——— ——— ——— var. *informis* Matthes, **179,** p. 71, pl. 4, fig. 57. Middle Oligocene, Germany.
——— ——— ——— var. *iniqua* Matthes, **179,** p. 70, pl. 4, fig. 55. Miocene, Germany.
——— ——— ——— var. *quadricincta-rotunda* Matthes, **179,** p. 70, pl. 4, fig. 56. Middle Oligocene, Germany.
——— *procera* Matthes, **179,** p. 81, pl. 6, fig. 109. Miocene, Germany.
——— *quadricincta-ovalis* Matthes, **179,** p. 69, pl. 4, fig. 48. Miocene, Germany.
——— *rivata* Matthes, **179,** p. 64, pl. 4, fig. 28. Middle Oligocene, Germany.
——— *salinensis* Howe, **128,** p. 51, pl. 6, fig. 14. Eocene, Cook Mountain formation, Louisiana.
——— *simpla* Matthes, **179,** p. 74, pl. 5, fig. 77. Miocene, Austria.
——— *simplicita* Matthes, **179,** p. 88, pl. 8, figs. 144–147. Oligocene, Germany. (For: *Ellipsolagena fusiformis* Wiesner, 1931, Deutsche Südpolar-Exped., vol. 20, Zool., p. 126, pl. 24, fig. j.)
——— *triangulata* Matthes, **179,** p. 69, pl. 4, figs. 45, 46. Miocene, Germany.
——— *trunciformis* Matthes, **179,** p. 90, pl. 8, fig. 152. Miocene, Germany. [For: *Lagena perforata* Rhumbler, 1911 (non Moebius, 1880), Foram. Plankton-Exped., vol. 1, pl. 22, fig. 34.]
——— *tubata* Matthes, **179,** p. 78, pl. 5, fig. 90. Miocene, Moravia.
——— *tuberosa* Matthes, **179,** p. 61, pl. 4, fig. 22. Middle Oligocene, Germany.
——— *tubospina* Matthes, **179,** p. 59, pl. 3, fig 16. Middle Oligocene, Germany.
——— *vadosa* Matthes, **179,** p. 75, pl. 5, fig. 81. Lower Oligocene, Germany.
——— *virgata* Matthes, **179,** p. 75, pl. 5, fig. 80. Miocene, Moravia.
Lagenammina cornuta Grubbs, **106,** p. 544, pl. 61, figs. 5, 6. Silurian, Chicago area, U.S.A.
——— *distorta* Ireland, **122,** p. 196, text figs. A-20, A-21. Silurian, Oklahoma.
Lenticulina jeffersonensis Garrett, **103,** p. 577, pl. 65, figs. 11, 12. Oligo-Miocene, Texas.
Lenticulina (*Robulus*) *taiwanensis* Ishizaki, **134,** p. 114, pl. 9, figs. 9, 10. Middle Miocene, Taiwan.
Lepidocyclina (*Lepidocyclina*) *formosensis* Hanzawa, Proc. Imp. Acad. Tokyo, vol. 15, p. 184, text figs. 2–4. Eocene, Formosa.
——— *gerthi* Caudri, **46,** p. 221, pl. 9, figs. 66, 67. Miocene, Java.
——— *multilobata* Caudri, **46,** p. 225, pl. 9, figs. 68–76. Miocene, Java. [For: *? Lepidocyclina ferreroi* Rutten, 1913 (non Provale, 1908), Samml. Reichs-Mus. Leiden, vol. 9, p. 293, pl. 22, fig. 1 (non figs. 2–5); and for: *? Lepidocyclina ferreroi* van der Vlerk, 1922 (non Provale, 1908), Verh. geol.-mijnbouwk. Genoot. Nederl. en Kol., geol. series, vol. 5, pl. 1, fig. 5.]
——— *ngampelensis* Gerth, in Caudri, **46,** p. 159, pl. 1, figs. 3, 4; pl. 2, fig. 6; pl. 3, fig. 8. Miocene, Java.
——— *vandervlerki* Caudri, **46,** p. 167, pl. 5, figs. 14–17. Miocene, Java.
Listerella levis Finlay, **96,** p. 97, pl. 14, fig. 79. Middle Eocene, New Zealand.
——— *weymouthi* Finlay, **96,** p. 96, pl. 14, figs. 80, 81. Middle Miocene, New Zealand.
Lituola erecta Mellen and Gault, **180,** p. 472, text fig. 4, middle row. Cretaceous, Mississippi.
——— ——— ——— ——— var. *distincta* Mellen and Gault, **180,** p. 473, text fig. 3; text fig. 4, top row. Cretaceous, Mississippi.
——— *irregulariter* Cushman, **59,** p. 89, pl. 16, figs. 9, 10. Upper Cretaceous, Texas. (Cave: *Lituola irregularis* Roemer, 1840.)
Lituotuba inflata Ireland, **122,** p. 201, text figs. B-34, B-35. Silurian, Oklahoma.
Loxostoma huneri Howe, **128,** p. 68, pl. 8, figs. 25, 26. Eocene, Cook Mountain formation, Louisiana. (Note: The correct spelling is: *Loxostomum.*)
Loxostomum irregulare Le Roy, **158,** p. 249, pl. 1, figs. 6, 7. Miocene, Central Sumatra.

Marginulina formosa Mjatliuk, **183,** p. 62, pl. 4, fig. 54. Upper Jurassic, Middle Volga region, USSR.
——— *huneri* Howe, **128,** p. 43, pl. 6, fig. 7. Eocene, Cook Mountain formation, Louisiana.
——— *winniana* Howe, **128,** p. 43, pl. 6, figs. 8, 9. Eocene, Cook Mountain formation, Louisiana.
Massilina columbiana Howe, **128,** p. 36, pl. 3, figs. 17, 18. Eocene, Cook Mountain formation, Louisiana.
——— *mauricensis* Howe and Ellis, **128,** p. 36, pl. 3, figs. 14–16. Eocene, Cook Mountain formation, Louisiana.
Millettella glabrella Cushman and McCulloch, **66,**

p. 43, pl. 2, fig. 3. Recent, Pacific, San Francisco Bay.

Nodogenerina sculpturata Cushman, **58,** p. 63, pl. 10, fig. 55. Upper Eocene, submarine core, off eastern coast of North America.

Nodophthalmidium, gen. nov., Macfadyen, **165,** p. 166. Fam. *Ophthalmidiidae.* Genotype: *Nodobacularia compressa* Rhumbler, 1906, Zool. Jahrb., vol. 24, p. 38, pl. 2, fig. 14. Recent, Adriatic Sea.

Nodosarella advena Cushman and Siegfus, **69,** p. 30, pl. 6, figs. 19, 20. Eocene, California.

——— *ignota* Cushman and Siegfus, **69,** p. 30, pl. 6, fig. 21. Eocene, California.

Nodosaria aliantanensis Le Roy, **158,** p. 236, pl. 5, figs. 14, 15. Miocene, Central Sumatra.

——— *blanpiedi* Ellis, **85,** p. 423, pl. 48, figs. 1–3. Oligo-Miocene, Mississippi.

——— *bulba* Howe, **128,** p. 46, pl. 6, fig. 5. Eocene, Cook Mountain formation, Louisiana.

——— *milamensis* Howe, **128,** p. 47, pl. 5, fig. 14. Eocene, Cook Mountain formation, Louisiana.

——— *osynkiensis* Mjatliuk, **183,** p. 64, pl. 2, figs. 27, 28. Upper Jurassic, Middle Volga region, USSR.

Nonion communis (d'Orbigny, 1826) var. *isphaerensis* Bykova, **41,** p. 25, pl. 3, figs. 17–19. Upper Cretaceous, Ferghana, USSR.

——— *decoratum* Cushman and McGlamery, **67,** p. 46, pl. 9, fig. 4. Lower Oligocene, Alabama. [For: *Nonion advenum* Cushman and McGlamery, 1938, (non Cushman, 1922), U. S. Geol. Surv., Prof. Pap. 189-D, p. 106, pl. 24, fig. 23 (non fig. 22). (Note: The species name is preoccupied by *Nonion communis* (d'Orbigny, 1826) var. *decorata* Jedlitschka, 1937, Zvlast. otisk. Vest. Prirod. Klubu Prostejove, vol. 25, p. 39, pl. 2, fig. 4, from the Torontian of Czechoslovakia.]

——— *mauricensis* Howe and Ellis, **128,** p. 57, pl. 8, figs. 1, 2. Eocene, Cook Mountain formation, Louisiana.

——— *preadvenum* Howe, **128,** p. 58, pl. 8, figs. 3, 4. Eocene, Cook Mountain formation, Louisiana.

——— *struma* Ellis, **85,** p. 423, pl. 48, figs. 4, 5. Oligo-Miocene, Mississippi.

——— *terquemianum* Cushman, **54,** p. 4, pl. 1, fig. 13. Eocene, France. (For: *Nonionina umbilicatula* Terquem, 1882, (non d'Orbigny, 1826), Soc. geol. France, Mém., (3), vol. 2, p. 42, pl. 2 (10), fig. 7.)

——— *usbekistanensis* Bykova, **41,** p. 24, pl. 3, figs. 15, 16. Upper Cretaceous, Ferghana, USSR.

Nonionella mauricensis Howe, **128,** p. 59, pl. 7, figs. 19–21. Eocene, Cook Mountain formation, Louisiana.

——— *oligocenica* Cushman and McGlamery, **67,** p. 47, pl. 9, fig. 5. Lower Oligocene, Alabama. (For: *Nonionella danvillensis* Cushman and McGlamery, 1938, (non Howe and Wallace, 1932), U. S. Geol. Surv., Prof. Pap. 189-D, p. 106, pl. 25, fig. 1).

——— *reussana* Cushman, **54,** p. 28, pl. 7, fig. 6. Upper Cretaceous, Germany.

——— *winniana* Howe, **128,** p. 60, pl. 7, figs. 26, figs. 26, 27. Eocene, Cook Mountain formation, Louisiana.

Notorotalia, gen. nov., Finlay, **94,** p. 517. Fam. *Rotaliidae.* Genotype: *Notorotalia zelandica* Finlay, 1939. Eocene to Recent.

——— *stachei* Finlay, **94,** p. 519, pl. 69, fig. 3. Middle Oligocene, New Zealand.

——— *zelandica* Finlay, **94,** p. 518. Description only, not figured. Upper Pliocene to Recent, New Zealand.

Nummulites canavarii Silvestri, **222,** p. 297, pl. 15, fig. 4. Neotriassic, Apuan Alps, Italy.

——— *eymari* Arni, **14,** p. 131, pl. 6, fig. 3; pl. 6, fig. 4; text fig. 11. Lower Eocene, Vicentino, Italy.

——— *parvulus* H. Douvillé, 1924, var. *corbarica* Arni, **14,** p. 139, pl. 7, fig. 6; text fig. 17. Lower Eocene, France.

——— *praelucasi* H. Douvillé, 1924, var. *ganensis* Arni, **14,** p. 142. Lower Eocene, France. (For: *Nummulites praelucasi* Bieda, 1933, (non H. Douvillé, 1924), Bull. Acad. Polon. Sci. Lettr., séries B, sci. nat., Classe 2, p. 185, pl. 13, fig. 1.)

Nuttallides, gen. nov., Finlay, **94,** p. 520. Fam. *Rotaliidae.* Genotype: *Eponides trümpyi* Nuttall, 1930, Jour. Paleont., vol. 4, pl. 24, figs. 9, 13, 14. Upper Cretaceous to Recent.

subtrümpyi Finlay, 94, p. 521. Description only, not figured. Eocene, New Zealand.

Operculina barkeri Vaughan and Cole, **257,** p. 538. (For: *Operculina tuberculata* Vaughan and Cole, 1936, U. S. Nat. Mus., Proc., vol. 83, p. 488, pl. 35, figs. 1–4, from Upper Eocene, of Mexico.)

——— *nummulitoides* Silvestri, **220,** p. 166, pl. 20, fig. 4. Middle Eocene, Somaliland.

Operculinoides jennyi Barker, **22,** p. 315, pl. 12, fig. 7; pl. 14, fig. 7; pl. 17, fig. 3; pl. 19, fig. 7; pl. 21, fig. 9. Upper Eocene, Mexico.

——— *muiri* Barker, **22,** p. 312, pl. 14, fig. 4; pl. 20, fig. 1; pl. 22, fig. 1. Lower Oligocene, Mexico.

——— *natchitochensis* Howe, **128,** p. 60, pl. 14, figs. 10, 11. Eocene, Cook Mountain formation, Louisiana.

——— *ocalanus* (Cushman, 1921), var. *minor* Barker, **22,** p. 317, pl. 12, fig. 4; pl. 15, figs. 1, 2; pl. 21, fig. 3. Middle Eocene, Mexico.

——— *palmarealensis* Barker, **22,** p. 314, pl. 13, fig. 8; pl. 18, fig. 1; pl. 22, figs. 7, 8. Lower Oligocene, Mexico.

——— *prenummultiformis* Barker, **22,** p. 311, pl. 12, figs. 1, 2; pl. 17, fig. 4; pl. 21, fig. 2. Middle Eocene, Mexico.

Ophthalmidium balkwilli Macfadyen, **165,** p. 166, text fig. 2. Subrecent, England. [For: *Ophthalmidium carinatum* Balkwill and Wright, 1885, (non *Oculina carinata* Kübler and Zwingli, 1866), Trans. Roy. Irish Acad. Sci., vol. 28, p. 326, pl. 12, figs. 13–16.]

Palmula huneri Howe, **128,** p. 49, pl. 6, figs. 28, 29. Eocene, Cook Mountain formation, Louisiana.

——— *primitiva* Cushman, **59,** p. 91, pl. 16, figs. 4, 5. Upper Cretaceous, Texas. [For: *Palmula simplex* Cushman, 1938 (non *Flabellina sim-*

plex Reuss, 1851), Contr. Cushman Lab. Foram. Res., vol. 14, p. 36, pl. 6, fig. 1.]

Parafusulina guatemalaensis Dunbar, **80,** p. 347, pl. 36, figs. 1–10. Middle Permian, Guatemala.

——— *imlayi* Dunbar, **81,** p. 1748, pl. 1, figs. 1–5. Permian, Sonora, Mexico.

——— *skinneri* Dunbar, **81,** p. 1749, pl. 2, figs. 1–7. Permian, Sonora, Mexico.

——— *sonoraensis* Dunbar, **81,** p. 1750, pl. 3, figs. 1–8. Permian, Sonora, Mexico.

Parrella, gen. nov., Finlay, **94,** p. 523. Fam. *Rotaliidae.* Genotype: *Anomalina bengalensis* Schwager, 1866, Novara-Exped., Geol. Theil, vol. 2, p. 259, pl. 7, fig. 111. Upper Cretaceous to Recent.

Perisphinctina, gen. nov., Wick, **271,** p. 482. Genotype: *Robulina articulata* Reuss, 1863, Sitzber. k. Akad. Wiss. Wien, vol. 48, 1864, p. 53, pl. 5, fig. 62; pl. 6, fig. 63. Middle Oligocene, Germany. [Note: This generic name is already preoccupied by Wedekind, 1937 (see reference in Jour. Paleont., vol. 15, 1941, p. 657). Wedekind, however, gives as genotype *Robulina depauperata* Reuss, 1851.]

——— *articulata* (Reuss, 1864) var. *costata* Wick, **271,** p. 487, pl. 21, figs. 3, 4. Middle Miocene, Germany.

Placopsilina bradyi Cushman and McCulloch, **66,** p. 112, pl. 12, figs. 14, 15. Recent, Pacific, off coast of Mexico, 55 fathoms. [For: *Placopsilina cenomana* Brady, 1884, (non d'Orbigny), Challenger Rept., vol. 9, p. 315, pl. 36, figs. 1–3.]

——— *? lineata* Grubbs, **106,** p. 545, pl. 61, figs. 11, 12. Silurian, Chicago area.

Planularia patens (H. B. Brady, 1884) var. *aspinosa* Le Roy, **158,** p. 238, pl. 3, figs. 4, 5. Miocene, Central Sumatra.

——— *winniana* Howe and Ellis, **128,** p. 42, pl. 4, fig. 7. Eocene, Cook Mountain formation, Louisiana.

Planulina evoluta Le Roy, **158,** p. 266, pl. 7, figs. 16, 17. Miocene, Central Sumatra.

——— *harangensis* Cushman and Ellisor, **63,** p. 14, pl. 2, fig. 9. Probably Miocene, Louisiana.

——— *kalimnensis* Parr, **190,** p. 69, pl. 1, fig. 19. Pliocene, southeastern Australia.

——— *kniffeni* Howe, **128,** p. 86, pl. 11, figs. 1–3. Eocene, Cook Mountain formation, Louisiana.

Plectofrondicularia awamoana Finlay, **96,** p. 100, only described, not figured. Middle Miocene, New Zealand.

——— *garzaensis* Cushman and Siegfus, **69,** p. 26, pl. 6, fig. 9. Eocene, California.

——— *longistriata* Le Roy, **158,** p. 241, pl. 5, figs. 4–6. Miocene, Central Sumatra.

——— *parri* Finlay, **94,** p. 516, pl. 68, fig. 4. Lower and Middle Miocene, New Zealand.

——— *pellucida* Finlay **96,** p. 99, pl. 11, fig. 7. Lowest Pliocene, New Zealand.

——— *pohana* Finlay, **94,** p. 516, pl. 68, fig. 3. Upper Miocene, New Zealand.

Pleurostomella nuttalli Cushman and Siegfus, **69,** p. 29, pl. 6, figs. 17, 18. Eocene, California.

Polymorphina advena Cushman, 1922, var. *nuda* Howe and Roberts, **128,** p. 56, pl. 7, fig. 4. Eocene, Cook Mountain formation, Louisiana.

——— *fiski* Howe, **128,** p. 56, pl. 7, fig. 2. Eocene, Cook Mountain formation, Louisiana.

——— *franquesi* Howe and Roberts, **128,** p. 57, pl. 7, figs. 5, 6. Eocene, Cook Mountain formation, Louisiana.

Proteonina compressa Cushman and McCulloch, **66,** p. 42, pl. 1, fig. 10. Recent, Pacific, off Alaska, 8 fathoms. (The species name is preoccupied by *Proteonina compressa* Paalzow, 1932, Jahrb. Ver. Vaterl. Naturk. Württemberg, vol. 88, p. 90, pl. 4, figs. 2, 3, from the Argovian of Germany.)

Psammonyx maxwelli Ireland, **122,** p. 201, text fig. B-22. Devonian, Oklahoma.

——— *bipartita* Ireland, **122,** p. 194, text fig. A-24, A-25. Devonian, Oklahoma.

Psammosphaera angularis Ireland, **122,** p. 192, text figs. A-8, A-9. Silurian, Oklahoma.

——— *gracilis* Ireland, **122,** p. 194, text figs. A-10, A-11. Silurian, Oklahoma.

Pseudobulimina glaessneri Howe and Roberts, **128,** p. 81, pl. 11, figs. 9–11. Eocene, Cook Mountain formation, Louisiana.

Pseudoclavulina columbiana Howe, **128,** p. 33, pl. 2, figs. 9, 10. Eocene, Cook Mountain formation, Louisiana.

Pseudoglandulina mauricensis Howe and Roberts, **128,** p. 48, pl. 6, fig. 10. Eocene, Cook Mountain formation, Louisiana.

——— *tutkowskii* Mjatliuk, **183,** p. 65, pl. 4, figs. 58, 57. Upper Jurassic, Middle Volga region, USSR.

Pseudopolymorphina victoriensis Parr, **190,** p. 67, pl. 1, fig. 4. Pliocene, southeastern Australia.

Pseudoschwagerina (*Zellia*) *nunosei* Hanzawa, **109,** p. 72, pl. 4, figs. 4–6. Lower Permian, Japan.

——— *schellwieni* Hanzawa, **109,** p. 71, pl. 4, figs. 1–3. Lower Permian, Japan.

Pullenia eocenica Cushman and Siegfus, **69,** p. 31, pl. 7, fig. 1. Eocene, California.

——— *riveroi* Bermudez, **25,** p. 11, pl. 2, figs. 1–6. Recent, Caribbean Sea, 570 fathoms.

Pulvinulinella atlantisae Cushman, **58,** p. 72, pl. 12, fig. 16. Upper Eocene, submarine core, off eastern coast of North America.

——— *huneri* Howe, **128,** p. 81, pl. 11, figs. 14–16. Eocene, Cook Mountain formation, Louisiana.

Quasifusulina longissima (Moeller, 1878) var. *brevis* Brazhnikova, **36,** p. 262, pl. 4, fig. 1. Middle Carboniferous, Dombas region, USSR.

Quinqueloculina bienvillensis Howe, **128,** p. 34, pl. 4, figs. 4–6. Eocene, Cook Mountain formation, Louisiana.

——— *eocenica* Cushman, **58,** p. 51, pl. 9, fig. 12. Upper Eocene, submarine core, off eastern coast of North America.

——— *harrisi* Howe and Roberts, **128,** p. 35, pl. 2, figs. 13–15. Eocene, Cook Mountain formation, Louisiana.

——— *mauricensis* Howe, **128,** p. 35, pl. 4, figs. 8–10. Eocene, Cook Mountain formation, Louisiana.

——— *newcombi* Le Roy, **158,** p. 232, pl. 2, figs. 6–8. Miocene, Central Sumatra.

——— *salinensis* Howe, **128,** p. 35, pl. 4, figs. 1–3. Eocene, Cook Mountain formation, Louisiana.

——— *torrei* Acosta, **3,** p. 1, pl. 1, figs. 1–5. Recent, off southern coast of Cuba.

Rectobolivina bortonica Finlay, **94,** p. 513, pl. 68, fig. 6. Middle Eocene, New Zealand.
——— *parvula* Finlay, **94,** p. 515, pl. 68, fig. 5. Miocene, New Zealand.
Recurvoides clenchi Bermudez, **26,** p. 60, pl. 5, figs. 7–9. Recent, off southern coast of Cuba, 615 fathoms.
Reophax formosensis Ishizaki, **134,** p. 110, pl. 8, fig. 1; pl. 9, fig. 6. Middle Miocene, Taiwan.
——— *suzakensis* Bykova, **41,** p. 16, pl. 1, figs. 2, 3. Upper Cretaceous, Ferghana, USSR.
Reussella aguayoi Bermudez, **28,** p. 250, pl. 33, fig. 5. Recent, Antillean region, 1175 fathoms.
——— *goochi* Howe, **128,** p. 70, pl. 8, figs. 38, 39, Eocene, Cook Mountain formation, Louisiana.
Riveroina, gen. nov., Bermudez, **28,** p. 248. Fam. *Miliolidae.* Genotype: *Riveroina caribaea* Bermudez, 1939. Recent, Antillean region.
——— *caribaea* Bermudez, **28,** p. 248, pl. 33, figs. 3, 4; text fig. 1. Recent, Antillean region, 190–250 fathoms.
Robertina lornensis Finlay, **96,** p. 114, pl. 12, figs. 27, 28. Lower Oligocene, New Zealand.
——— *mcguirti* Howe, **128,** p. 82, pl. 8, figs. 23, 24. Eocene, Cook Mountain formation, Louisiana.
Robertinidae, fam. nov., Finlay, **96,** p. 112. Includes the genera *Robertina* d'Orbigny, 1846, *Ceratobulimina* Toula, 1915 (non 1920), *Pseudobulimina* Earland, 1934, *Cerobertina* Finlay, 1939, and *Ceratocancris* Finlay, 1939, a subgenus of *Ceratobulimina* Toula, 1915. Tertiary and Recent.
Robulina angulata Reuss, 1851, var. *costata* Wick, **271,** p. 478, pl. 8, fig. 6. Lower Oligocene, Germany. [Note: The varietal name is preoccupied by *Robulina costata* (d'Orbigny) in Fornasini, 1902, Mem. Accad. Sci. Ist. Bologna, (5), vol. 10, p. 43, text figs. 44, 46 and 49.]
——— *callocostata* Wick, **271,** p. 487, pl. 21, fig. 2. Middle Miocene, Germany.
——— *magna* Wick, **271,** p. 490, pl. 23, fig. 1. Upper Miocene, Germany. (Note: The species name is preoccupied by *Robulina magna* Costa, 1856, Atti Accad. Pont. Napoli, vol. 7, p. 193, pl. 19, figs. 2A, C.)
Robulus atlantisae Cushman, **58,** p. 54, pl. 9, figs. 22, 23. Upper Eocene, submarine core, off eastern coast of North America.
——— *chambersi* Garrett, **103,** p. 576, pl. 65, figs. 8, 9. Oligo-Miocene, Texas.
——— *lacerta* Garrett, **103,** p. 576, pl. 65, figs. 6, 7. Oligo-Miocene, Texas.
——— *mayeri* Cushman and Ellisor, **63,** p. 4, pl. 1, fig. 6. Miocene, Louisiana.
——— *stephensoni* Cushman, **59,** p. 90, pl. 16, figs. 2, 3. Upper Cretaceous, Tennessee.
——— *submarinus* Cushman, **58,** p. 53, pl. 9, figs. 18, 19. Upper Eocene, submarine core, off eastern coast of North America.
——— *sumatrensis* Le Roy, **158,** p. 233, pl. 4, figs. 4, 5. Miocene, Central Sumatra.
——— *tangens* Le Roy, **158,** p. 233, pl. 8, figs. 12, 13. Miocene, Central Sumatra.
Rotalia beccarii (Linnaeus, 1758) var. *baganensis* Le Roy, **158,** p. 257, pl. 7, figs. 26–28. Miocene, Central Sumatra.
——— ——— ——— var. *gigantica* Le Roy, **158,** p. 256, pl. 6, figs. 20–22. Miocene, Central Sumatra.
——— ——— ——— var. *koeboensis* Le Roy, **158,** pl. 6, figs. 13–15. Miocene, Central Sumatra.
——— *hamiltonensis* Parr, **190,** p. 69, pl. 1, fig. 17. Pliocene, southeastern Australia.
——— *indica* Le Roy, **158,** p. 257, pl. 2, figs. 17–19. Miocene, Central Sumatra.
Rudigaudryina, gen. nov., Cushman and McCulloch, **66,** p. 94. Fam. *Verneuilinidae.* Genotype: *Rudigaudryina inepta* Cushman and McCulloch, 1939. Recent, Pacific.
——— *inepta* Cushman and McCulloch, **66,** p. 94, pl. 9, figs. 3–10. Recent, Pacific, 80 fathoms.
Rupertia (?) adamsi Cushman, **56,** p. 22, pl. 5, figs. 1–11. Pliocene, California.

Saccammina moremani Ireland, **122,** p. 196, text fig. A-12. Silurian, Oklahoma.
Semivulvulina, subgen. nov., Finlay, **94,** p. 505. Subgenus of *Vulvulina* d'Orbigny, 1826. Subgenotype: *Textilaria capitata* Stache, 1864, Novara Exped., Geol. Theil., vol. 1, p. 270, pl. 24, fig. 10. Fam. *Textulariidae.* Middle Oligocene to Lower Miocene.
Schubertella parakingi Brazhnikova, **36,** p. 247, pl. 1, figs. 1–3. Middle Carboniferous, Dombas district, USSR.
Sigmoilina inconspicua Howe, **128,** p. 36, pl. 2, figs. 16–18. Eocene, Cook Mountain formation, Louisiana.
Sigmomorphina mindensis Howe, **128,** p. 55, pl. 5, figs. 23, 24. Eocene, Cook Mountain formation, Louisiana.
Siphogenerina fredsmithi Garrett, **103,** p. 577, pl. 66, fig. 1. Oligo-Miocene, Texas.
——— *ongleyi* Finlay, **96,** p. 111, pl. 13, figs. 42, 43. Lower Miocene, New Zealand.
——— *panggoeensis* Le Roy, **158,** p. 252, pl. 8, fig. 11. Miocene, Central Sumatra.
——— *pohana* Finlay, **96,** p. 109, pl. 13, figs. 44, 45. Upper Miocene, New Zealand.
——— *postprandia* Finlay, **96,** p. 108, pl. 13, figs. 40, 41. Lower Oligocene, New Zealand.
——— *prisca* Finlay, **96,** p. 110, pl. 13, figs. 48–51. Middle Miocene, New Zealand.
——— *rerensis* Finlay, **96,** p. 108, pl. 11, fig. 8. Lower Miocene, New Zealand. [For: *Uvigerina tenuistriata* Chapman, 1926, (non Reuss), New Zealand Geol. Surv., Paleont. Bull., vol. 11, pl. 14, fig. 9.]
——— *vesca* Finlay, **96,** p. 109, pl. 13, figs. 46, 47. Lower Miocene, New Zealand.
Siphogenerinoides brevispinosa Cushman, **59,** p. 92, pl. 16, fig. 7. Upper Cretaceous, Arkansas.
Siphonina davisi Cushman and Ellisor, **63,** p. 10, pl. 2, fig. 3. Lower Oligocene, Louisiana.
——— *goochi* Howe, **128,** p. 77, pl. 10, fig. 12. Eocene, Cook Mountain formation, Louisiana.
Siphoninella chambersi Howe and Roberts, **128,** p. 77, pl. 10, figs. 7–9. Eocene, Cook Mountain formation, Louisiana.
Siphonodosaria australis Parr, **190,** p. 68, pl. 1, figs. 15, 16. Pliocene, southeastern Australia.

——— *excentrica* Le Roy, **158,** p. 252, pl. 7, figs. 36, 37. Miocene, Central Sumatra.

Siphotextularia, gen. nov., Finlay, **94,** p. 510. Fam. *Textulariidae*. Genotype: *Siphotextularia wairoana* Finlay, 1939. Eocene to Recent.

——— *awamoana* Finlay, **96,** p. 91, pl. 14, figs. 89, 90. Middle Miocene, New Zealand.

——— *wairoana* Finlay, **94,** p. 511, pl. 68, fig. 2. Lower and Middle Pliocene, New Zealand.

Sorosphaera irregularis Grubbs, **106,** p. 544, pl. 61, fig. 4. Silurian, Chicago.

Spiroclypeus higginsi Cole, **49,** p. 185, pl. 23, figs. 10–15; pl. 24, fig. 13. Lowermost Miocene, Guam Island, Pacific.

Spiroloculina wilcoxensis Cushman and Garrett, **64,** p. 78, pl. 13, figs. 5, 6. Eocene, Alabama.

Spiroplectammina arenacea Le Roy, **158,** p. 228, pl. 3, figs. 16–18, 23, 24. Miocene, Central Sumatra.

——— *arenasuturata* Le Roy, **158,** p. 229, pl. 4, figs. 17–19. Miocene, Central Sumatra.

——— *barrowi* Cushman and Ellisor, **63,** p. 1, pl. 1, fig. 1. Miocene, Louisiana.

——— *jarvisi* Cushman, **59,** p. 90, pl. 16, fig. 1. Upper Cretaceous, Trinidad. [For: *Spiroplectammina anceps* (Reuss) *var.* Cushman and Jarvis, 1932, Proc. U. S. Nat. Mus., vol. 80, Art. 14, p. 14, pl. 3, fig. 8.]

——— *natchitochensis* Howe, **128,** p. 31, pl. 1, figs. 6, 7. Eocene, Cook Mountain foramatic n, Louisiana.

Spiroplectoides attenuatus Cushman, **58,** p. 62, pl. 10, figs. 47–49. Upper Eocene, submarine core, off eastern coast of North America.

——— *directa* Cushman and Siegfus, **96,** p. 26, pl. 6, figs. 7, 8. Eocene, California.

Staffella (Orobias) nikitovkensis Brazhnikova, **36,** p. 252, pl. 2, figs. 6–9. Middle Carboniferous, Dombas District, USSR.

Stegnammina elongata Ireland, **122,** p. 194, text fig. A-17. Devonian, Oklahoma.

Textularia awazea Finlay, **94,** p. 508, pl. 69, fig. 2. Middle Miocene, New Zealand.

——— *cuspis* Finlay, **96,** p. 90, pl. 14, figs. 63, 64. Lower Oligocene, New Zealand.

——— *kansaiensis* Ishizaki, **134,** p. 110, pl. 8, fig. 2; text fig. 1. Middle Miocene, Taiwan.

——— *malaccensis* Le Roy, **158,** p. 230, pl. 9, figs. 4, 5. Miocene, Central Sumatra.

——— *marsdeni* Finlay, **96,** p. 90, pl. 14, fig. 67. Lower Miocene, New Zealand.

——— *mornhinvegi* Garrett, **103,** p. 575, pl. 65, figs. 1, 2. Oligo-Miocene, Texas.

——— *tatumi* Cushman and Ellisor, **63,** p. 2, pl. 1, fig. 2. Miocene, Louisiana.

——— *teasi* Cushman and Ellisor, **63,** p. 2, pl. 1, fig. 3. Miocene, Louisiana.

——— *zeaggluta* Finlay, **96,** p. 89, pl. 14, figs. 65, 66. Middle Eocene, New Zealand.

Tholosina sedentata Ireland, **122,** p. 198, text figs. B.-16, B.-17. Silurian, Oklahoma.

Thurammina cylindrica Grubbs, **106,** p. 545, pl. 61, fig. 13. Silurian, Chicago.

——— *delicata* Ireland, **122,** p. 196, text figs. A-28, A-29. Silurian, Oklahoma.

——— *globosa* Ireland, **122,** p. 196, text figs. B-5, B-6. Silurian, Oklahoma.

——— *globula* Grubbs, **106,** p. 545, pl. 61, figs. 9, 10. Silurian, Chicago.

——— *papillata* Brady, 1879, var. *monticulifera* Ireland, **122,** p. 197, text fig. A-35. Silurian, Oklahoma.

——— *polygona* Ireland, **122,** p. 197, text fig. B-12, Silurian, Oklahoma.

——— *sphaerica* Ireland, **122,** p. 197, text figs. A-33, A-34, Silurian, Oklahoma.

——— *subpapillata* Ireland, **122,** p. 197, text fig. A-36. Silurian, Oklahoma.

——— *transversalis* Ireland, **122,** p. 197, text fig. B-3. Silurian, Oklahoma.

——— *unitubula* Grubbs, **106,** p. 545, pl. 61, fig. 7. Silurian, Chicago.

Triloculina garretti Howe, **128,** p. 37, pl. 2, figs. 3–5. Eocene, Cook Mountain formation, Louisiana.

——— *mindenensis* Howe, **128,** p. 37, pl. 3, figs. 11–13. Eocene, Cook Mountain formation, Louisiana.

——— *natchitochensis* Howe, **128,** p. 38, pl. 3, figs. 3–5. Eocene, Cook Mountain formation, Louisiana.

Tritaxilina languida Finlay, **96,** p. 98, pl. 13, fig. 38. Middle Eocene, New Zealand.

——— *zealandica* Finlay, **96,** p. 97, pl. 13, fig. 36. Middle Oligocene, New Zealand.

Triticites plicatulus Merchant and Keroher, **181,** p. 609, pl. 69, figs. 13–15. Pennsylvanian, Missouri Series, Kansas.

——— *secalicus* (Say, 1823) var. *primarius* Merchant and Keroher, **181,** p. 611, pl. 69, figs. 10–12; text figs. 2, 3. Pennsylvanian, Missouri Series, Kansas. [For: *Triticites secalicus* (Say) in Dunbar and Condra, 1927, Nebraska Geol. Surv. Bull. no. 2, (2), p. 104, pl. 7, figs. 1–7; pl. 8, fig. 6; pl. 11, fig. 7.]

——— *tenuis* Merchant and Keroher, **181,** p. 604. pl. 69, figs. 1–3; text figs. 2–2. Pennsylvanian, Missouri Series, Kansas.

Tritubulogenerina, gen. nov., Howe, **128,** p. 69. Fam. *Buliminidae*. Genotype: *Tritubulogenerina mauricensis* Howe, 1939. Eocene.

——— *mauricensis* Howe, **128,** p. 69, pl. 8, figs. 34, 35. Eocene, Cook Mountain formation, Louisiana.

Trochammina carinata Cushman and McCulloch, **66,** p. 109, pl. 12, fig. 3. Recent, Pacific, off coast of California, 80 fathoms.

——— *claibornensis* Howe, **128,** p. 40, pl. 4, figs. 11, 12. Eocene, Cook Mountain formation, Louisiana.

——— *neocomiana* Mjatliuk, **183,** p. 51, pl. 1, fig. 10. Neocomian, Middle Volga region, USSR.

——— *pacifica* Cushman, 1925, var. *simplex* Cushman and McCulloch, **66,** p. 104, pl. 11, fig. 4. Recent, Pacific, off Lower California, Mexico. 20 fathoms. (Note: The varietal name is preoccupied by *Trochammina simplex* Friedberg, 1902, Rozpr. wyd. math.-przyr. Akad. Umiej. Krakovie, vol. 41, p. 641, pl. 2, fig. 4.)

——— *squamiformis* Cushman and McCulloch, **66,** p. 108, pl. 12, fig. 4. Recent, Pacific, off coast of Washington, 2 fathoms.

Uvigerina alabamensis Cushman and Garrett, **64,** p. 83, pl. 14, figs. 26, 27. Eocene, Alabama.

——— *altacostata* Cushman and Ellisor, **63,** p. 9, pl. 1, fig. 14. Probably Miocene, Louisiana.
——— *churchi* Cushman and Siegfus, **69,** p. 29, pl. 6, fig. 16. Eocene, California.
——— *costellata* Morozova, **185,** p. 76, pl. 2, fig. 5. Eocene, Emba region, USSR.
——— *doreeni* Finlay, **96,** p. 101, not figured, only described. Upper Oligocene, New Zealand.
——— *garzaensis* Cushman and Siegfus, **69,** p. 28, pl. 6, fig. 15. Eocene, California.
——— *howei* Garrett, **103,** p. 577, pl. 65, figs. 13, 17. Oligo-Miocene, Texas.
——— *israelskyi* Garrett, **103,** p. 577, pl. 65, figs. 15, 16. Oligo-Miocene, Texas.
——— *lirettensis* Cushman and Ellisor, **63,** p. 6, pl. 1, fig. 13. Miocene, Louisiana.
——— *mioschwageri* Finlay, **96,** p. 103, pl. 12, figs. 15–17. Middle Miocene, New Zealand.
——— *miozea* Finlay, **96,** p. 102, pl. 12, figs. 12–14. Lower Miocene, New Zealand.
——— *multicostata* Le Roy, **158,** p. 251, pl. 2, figs. 4, 5; pl. 7, figs. 3–5. Miocene, Central Sumatra.
——— *paeneteres* Finlay, **96,** p. 103. Not figured, only described. Middle Miocene, New Zealand.
——— *pilulata* Cushman and Ellisor, **63,** p. 7, pl. 1, fig. 12. Oligocene, Louisiana.
——— *russelli* Howe, **128,** p. 71, pl. 8, figs. 21, 22. Eocene, Cook Mountain formation, Louisiana.
——— *soendanensis* Le Roy, **158,** p. 251, pl. 4, figs. 1–3. Miocene, Central Sumatra.
——— *spinicostata* Cushman and Jarvis, 1929, var. *acuminata* Thalmann, Paleont. Zentralbl., vol. 13, p. 340, review no. 1277. [For: *Uvigerina spinicostata* Cushman and Jarvis, 1929, var. *alazanensis* Nuttall, 1932 (non *Uvigerina alazanensis* Nuttall, 1932, Jour. Paleont., vol. 6, p. 22, pl. 5, fig. 10), Jour. Paleont., vol. 6, p. 23, pl. 6, fig. 1; for the same reference in Cushman and Edwards, 1938, Contr. Cushman Lab. Foram. Res., vol. 14, p. 78, pl. 13, fig. 16; and for: *Uvigerina spinicostata* Cushman and Jarvis, 1929, *var.* in Cushman and Jarvis, 1929, Contr. Cushman Lab. Foram. Res., vol. 5, p. 12, pl. 3, figs. 9, 10.] Oligocene.
——— *wilcoxensis* Cushman and Garrett, **64,** p. 82, pl. 14, figs. 17, 18. Eocene, Alabama.

Vaginulina atlantisae Cushman, **58,** p. 59, pl. 10, figs. 23–26. Upper Eocene, submarine core, off eastern coast of North America.
——— *deprofunda* Cushman, **58,** p. 58, pl. 10, figs. 18–22. Upper Eocene, submarine core, off eastern coast of North America.
Valvulineria advena Cushman and Siegfus, **69,** p. 31, pl. 6, fig. 22. Eocene, California.
Verneuilina browni Finlay, **96,** p. 91, pl. 14, figs. 72, 73. Middle Oligocene, New Zealand.
——— *neocomiensis* Mjatliuk, **183,** p. 50, pl. 1, figs. 12, 13. Neocomian, Middle Volga region, USSR.
Virgulina alabamensis Cushman and McGlamery, **67,** p. 48, pl. 9, fig. 7. Lower Oligocene, Alabama.
——— *exilis* Cushman and Ellisor, **63,** p. 6, pl. 1, fig. 11. Oligocene, Louisiana.
——— *mcguirti* Howe and Roberts, **128,** p. 65, pl. 9, fig. 1. Eocene, Cook Mountain formation, Louisiana.
Vulvulina ignava Garrett, **103,** p. 575, pl. 65, figs. 3–5. Oligo-Miocene, Texas.
——— (*Semivulvulina*) *waitakia* Finlay, **94,** p. 507, pl. 68, fig. 1. Upper Oligocene to Lower Miocene, New Zealand.

Webbinella bipartita Ireland, **122,** p. 198, text figs. B-14, B-15. Devonina, Oklahoma.
——— *coronata* Ireland, **122,** p. 198, text fig. B-11. Silurian, Oklahoma.
——— *gibbosa* Ireland, **122,** p. 198, text figs. B-23, B-24. Silurian, Oklahoma.

Zeauvigerina, gen. nov., Finlay, **95,** p. 541. Fam. *Heterohelicidae.* Genotype: *Zeauvigerina zelandica* Finlay, 1939. Upper Middle Eocene.
——— *zelandica* Finlay, **95,** p. 541, pl. 69, fig. 4. Upper Middle Eocene, New Zealand.

NOMEN NUDUM

Fusulina illinoisensis Dunbar and Henbest, in Cady, **42,** p. 1523. Pennsylvanian, Illinois.

LIST OF FORMS WITH NOMENCLATURA APERTA

Amphistegina ? sp? Silvestri, **222,** p. 298, pl. 15, figs. 3–5. Triassic, Italy.
Cibicides sp. Cushman and Garrett, **64,** p. 88, pl. 15, figs. 23, 24. Eocene, Alabama.
Clavulina ? sp. Ishizaki, **134,** p. 112, pl. 8, fig. 10. Middle Miocene, Taiwan.
Cristellaria sp. Mjatliuk, **183,** p. 53, pl. 3, fig. 33. Upper Jurassic, Russia.
Dentalina sp. Howe, **128,** p. 46, pl. 6, fig. 5. Eocene, Louisiana.
——— *sp.* (*?*) *A* Cushman, **58,** p. 57, pl. 10, fig. 2. Upper Eocene, off eastern coast of North America.
——— *sp. A* Le Roy, **158,** p. 235, pl. 9, fig. 14. Miocene, Sumatra.
——— *sp.* (*?*) *B* Cushman, **58,** p. 57, pl. 10, figs. 3, 4. Upper Eocene, off eastern coast of North America.
——— *sp.* (*?*) *C* Cushman, **58,** p. 57, pl. 10, figs. 5, 6. Upper Eocene, off eastern coast of North America.
——— *sp.* (*?*) *D* Cushman, **58,** p. 57, pl. 10, figs. 7, 8. Upper Eocene, off eastern coast of North America.
Elphidium sp. A Le Roy, **158,** p. 239, pl. 8, figs. 9, 10. Miocene, Sumatra.
Gaudryina sp. Cushman and Garrett, **64,** p. 78, pl. 13, fig. 3. Eocene, Alabama.
Globigerina sp. Howe, **128,** p. 84, pl. 12, fig. 14. Eocene, Louisiana.
Guttulina sp. Ishizaki, **134,** p. 117, pl. 8, fig. 12. Middle Miocene, Taiwan.
Haplophragmoides sp. Bykova, **41,** p. 18, pl. 1, figs. 11, 12. Upper Cretaceous, Russia.
Heterillina sp. Silvestri, **220,** p. 92, pl. 21, fig. 10; pl. 21, fig. 9 (?). Eocene, Somaliland.
Heterostegina sp. ? Silvestri, **222,** p. 298, pl. 15, figs. 2, 6. Triassic, Italy.
Karreriella ? sp. Ishizaki, **134,** p. 113, pl. 8, fig. 6. Middle Miocene, Taiwan.
Lagena sp. (*?*) Cushman, **58,** p. 60, pl. 10, fig. 29.

Upper Eocene, off eastern coast of North America.

——— *sp.* (*?*) Cushman, **58,** p. 60, pl. 10, figs. 30, 31. Upper Eocene, off eastern coast of North America.

——— *sp. A* Le Roy, **158,** p. 238, pl. 7, figs. 9, 10. Miocene, Sumatra.

Lepidocyclina sp. Cole, **49,** p. 188, pl. 23, fig. 8. Miocene, Guam.

——— *sp.* Cole, **49,** p. 188, pl. 23, fig. 9. Miocene, Guam.

——— *sp. nov.* Rao, **199,** p. 167, text fig. 1. Miocene, British India.

Marginulina sp. (*?*) Cushman, **58,** p. 56, pl. 9, fig. 29. Upper Eocene, off eastern coast of North America.

——— *sp.* Howe, **128,** p. 43, pl. 4, fig. 15. Eocene, Louisiana.

Marginulinopsis sp. Ishizaki, **134,** p. 115, pl. 8, fig. 13. Middle Miocene, Taiwan.

Miliolina sp. 1 Bykova, **41,** p. 23, pl. 2, figs. 1, 2. Upper Cretaceous, Russia.

——— *sp. 2* Bykova, **41,** p. 23, pl. 2, figs. 3–5. Upper Cretaceous, Russia.

——— *sp. 3* Bykova, **41,** p. 24, pl. 2, figs. 9–11. Upper Cretaceous, Russia.

Nodosarella sp. (*?*) Cushman, **58,** p. 68, pl. 11, figs. 23, 24. Upper Eocene, off eastern coast of North America.

Nodosaria sp. (*?*) Cushman, **58,** p. 58, pl. 10, fig. 14. Upper Eocene, off eastern coast of North America.

——— *sp.* (*?*) Cushman, **58,** p. 58, pl. 10, fig. 13. Upper Eocene, off eastern coast of North America.

Nonionella sp. 1 Bykova, **41,** p. 26, pl. 3, figs. 20–22. Upper Cretaceous, Russia.

Operculina sp. Silvestri, **222,** p. 298, pl. 15, fig. 7. Triassic, Italy.

——— *sp.* Hanzawa, **110,** p. 229, pl. 15, figs. 9, 11; pl. 16, figs. 8, 9 (non fig. 10). Recent, Japan.

Operculinoides species A Barker, **22,** p. 321, pl. 15, fig. 4; pl. 21, fig. 6. Upper Eocene, Mexico.

——— *species B* Barker, **22,** p. 321, pl. 12, fig. 3; pl. 20, fig. 7; pl. 21, fig. 5. Middle Eocene, Mexico.

? ——— *species* Barker, **22,** p. 322, pl. 20, fig. 6; pl. 21, fig. 4. Upper Eocene, Mexico.

Palmula sp. Ishizaki, **134,** p. 116, pl. 8, fig. 11. Middle Miocene, Taiwan.

Parafusulina sp. A Dunbar, **81,** p. 1753, pl. 4, figs. 7, 8. Permian, Mexico.

——— *sp. B* Dunbar, **81,** p. 1753, pl. 4, figs. 5, 6. Permian, Mexico.

——— *sp. C* Dunbar, **81,** p. 1753, pl. 4, figs. 3, 4. Permian, Mexico.

Planularia sp. Cushman and Garrett, **64,** p. 80, pl. 13, fig. 13. Eocene, Alabama.

Quinqueloculina sp. Cushman and Garrett, **64,** p. 78, pl. 13, fig. 4. Eocene, Alabama.

——— *sp. A* Le Roy, **158,** p. 231, pl. 5, figs. 9–11. Miocene, Sumatra.

Ramulina (*?*) *sp.* (*?*) Cushman, **58,** p. 61, pl. 10, figs. 39, 40. Upper Eocene, off eastern coast of North America.

——— *sp.* Howe, **128,** p. 57, pl. 8, fig. 8. Eocene, Louisiana.

Reophax sp. (*?*) Cushman and McCulloch, **66,** p. 63, pl. 3, fig. 13. Recent, Pacific.

Robulus sp. Cushman and Garrett, **64,** p. 79, pl. 13, figs. 9, 10. Eocene, Alabama.

Saccammina ? sp. Ireland, **122,** p. 196, text figs. A-18, A-19, Silurian, Oklahoma.

Siphonodosaria sp. Ishizaki, **134,** p. 116, pl. 8, figs. 9, 15. Middle Miocene, Taiwan.

Spirillina sp. Howe, **128,** p. 72, pl. 10, fig. 32. Eocene, Louisiana.

Spiroloculina sp. Cushman and Garrett, **64,** p. 79, pl. 13, fig. 7. Eocene, Alabama.

——— *sp.* Silvestri, **220,** p. 85, pl. 3, fig. 2. Eocene, Somaliland.

——— *sp.* Silvestri, **220,** p. 85, pl. 6, fig. 5. Eocene, Somaliland.

Textularia sp. Ishizaki, **134,** p. 111, pl. 8, fig. 3. Middle Miocene, Taiwan.

Tritaxia sp. Silvestri, **220,** p. 136, pl. 6, fig. 3. Eocene, Somaliland.

Triticites sp. A Dunbar, **81,** p. 1752, pl. 4, figs. 1, 2A. Permian, Mexico.

——— *sp. B* Dunbar, **81,** p. 1752, pl. 4, fig. 2B. Permian, Mexico.

——— *sp. no. 1* Brazhnikova, **36,** p. 269, pl. 5, fig. 2. Carboniferous, Russia.

——— *sp. no. 2* Brazhnikova, **36,** p. 271, pl. 5, fig. 5. Carboniferous, Russia.

Turrilina sp. Morozova, **185,** p. 74, pl. 2, fig. 22. Cenomanian, Russia.

Verneuilina sp. Ishizaki, **134,** p. 112, pl. 8, fig. 16. Middle Miocene, Taiwan.

Vulvulina sp. Morozova, **185,** p. 72, pl. 2, fig. 20. Paleocene, Russia.

SUPPLEMENTS TO INDEX OF NEW SPECIES FOR THE YEAR 1932

Fusulinella usvae Doutkevitch, 1932, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc. 30, p. 15. Fully described, but not figured. Paleozoic, Russia.

Saracenaria saratogana Howe and Wallace, 1932, Louisiana Geol. Bull. no. 2, p. 40. Upper Cretaceous, Arkansas. [For: *Saracenaria italica* Cushman, 1931 (non Defrance, 1824), Jour. Paleont., vol. 5, p. 305, pl. 34, figs. 15, 16.]

SUPPLEMENTS TO INDEX OF NEW SPECIES FOR THE YEAR 1934

Ammodiscus sp. Dain, 1934, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc. 43, p. 13, pl. 1, fig. 1. Albian, Temir region, USSR.

Biloculina sp. Llopis i Llado, **293,** p. 164, pl. 14, figs. 1, 2. Upper Cretaceous, Spain.

Cuneolina sp. Llopis i Llado, **293,** p. 162, pl. 13, fig. 5. Upper Cretaceous, Spain.

Cuneolina nov. spec. ? Llopis i Llado, **293,** p. 160, pl. 13, fig. 1. Senonian, Spain.

Discorbis sp. Llopis i Llado, **293,** p. 166, pl. 14, figs. 4, 7. Upper Cretaceous, Spain.

Fusiella granum-oryzae Doutkevitch, 1934, Trans. Geol. Oil-Prospect. Inst., Leningrad-Moscow, series A, fasc. 36, p. 9, pl. 1, figs. 1–8. Uralian, Middle Urals, USSR.

Fusulinella librovitschi Doutkevitch, 1934, *ibidem*, p. 43, pl. 5, figs. 1–5. Moscovian, Middle Urals, USSR.

——— *uralica* Doutkevitch, 1934, *ibidem*, p. 47, pl. 5, figs. 6–16. Moscovian, Middle Urals, USSR.

Globigerina sp. Llopis i Llado, **293,** p. 167, pl. 14, figs. 8, 9. Upper Cretaceous, Spain.

Haplophragmoides excavata Cushman and Waters var. *umbilicatula* Dain, 1934, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc. 43, p. 13, pl. 1, fig. 2. Aptian, Temir region, USSR.

Heterostomella sp. Dain, 1934, *ibidem*, p. 17, pl. 1, fig. 5. Lower Senonian, Temir region, USSR.

Lenticulina sp. Dain, 1934, *ibidem*, p. 22, pl. 2, fig. 13. Upper Jurassic, Temir region, USSR.

Nodosaria sp. Llopis i Llado, **293,** p. 166, pl. 14, fig. 3. Upper Cretaceous, Spain.

Nummoloculina sp. Llopis i Llado, **293,** p. 164, pl. 13, fig. 12. Upper Cretaceous, Spain.

Pseudouvigerina cretacea Cushman var. *triangularis* Dain, 1934, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc. 43, p. 35, pl. 3, fig. 37. Senonian, Temir region, USSR. (Note: This variety preoccupies *Pseudovigerina triangularis* Jennings, 1936, Bull. Amer. Paleont., vol. 23, no. 78, p. 29, pl. 3, fig. 16, which should be renamed.)

Quinqueloculina sp. Llopis i Llado, **293,** p. 163, pl. 13, fig. 9. Upper Cretaceous, Spain.

Rotalia sp. Llopis i Llado, **293,** p. 166, pl. 14, fig. 6. Upper Cretaceous, Spain.

Rzehakina (spelled *Rzeaquina*) *sp.* Llopis i Llado, **293,** p. 163, pl. 13, fig. 7. Upper Cretaceous, Spain.

Staffella antiqua Doutkevitch, 1934, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc., 55, text figs. 4–6. Middle Carboniferous, Urals, USSR.

——— *dagmarae* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 22, pl. 3, figs. 11–15. Uralian, Middle Urals, USSR.

——— *ivanovi* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 34, pl. 4, figs. 9–11. Uralian, Middle Urals, USSR.

——— *leei* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 27, pl. 4, figs. 1, 2. Uralian, Middle Urals, USSR.

——— *mathildae* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 37, pl. 4, figs. 12–16. Uralian, Middle Urals.

——— *nov. sp. ?* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 41, pl. 4, fig. 17. Uralian, Middle Urals, USSR.

——— *paradoxa* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 14, pl. 1, figs. 9, 10; pl. 2, figs. 1–10. Moscovian, Middle Urals, USSR.

——— *preobrajenskyi* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 30, pl. 4, figs. 3–8. Uralian, Middle Urals, USSR.

——— *pseudosphaeroidea* Doutkevitch, 1934, *ibidem*, fasc. 36, p. 17, pl. 3, figs. 2–10. Moscovian, Middle Urals, USSR.

Triplasia temirica Dain, 1934, *ibidem*, fasc. 43, p. 29, pl. 3, fig. 25. Upper Jurassic, Temir region, USSR.

SUPPLEMENTS TO INDEX OF NEW SPECIES FOR THE YEAR 1935

Cassidulina spec. indet. Voloshinova, **299,** p. 10, text fig. 3. Pliocene, Sakhalin, USSR.

Haplophragmoides glomeratum (H. B. Brady) var. *sahalinica* Voloshinova, **299,** p. 6, pl. 1, fig. 3. Pliocene, Sakhalin, USSR.

——— *spec. indet.* Voloshinova, **299,** p. 6, pl. 1, fig. 6. Pliocene, Sakhalin, USSR.

Hyperammina sp. Voloshinova, **299,** p. 5, pl. 1, fig. 5. Pliocene, Sakhalin, USSR.

Nummulites sp. Metalnikov, 1935, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series B, fasc. 51, p. 40, pl. 1, fig. 5; pl. 2, figs. 1, 2, 7. Eocene, Sotchy, USSR.

SUPPLEMENTS TO INDEX OF NEW SPECIES FOR THE YEAR 1936

Archaediscus baschkiricus Krestovnikoff and Theodorovitch, 1936, Soc. Natural. Moscou, Bull., new series, vol. 44, sect. géol., vol. 14, p. 87, text figs. 2, 3. Carboniferous, Southern Urals, USSR.

Bathysiphon sp. (?) Subbotina, 1936, Trans., Geol. Oil-Prospect. Inst. Leningrad-Moscow, series B, fasc. 60, p. 5, pl. 1, fig. 3. Oligocene, Northern Caucasus, USSR.

Globorotalia pentacamerata Subbotina, 1936, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series A, fasc. 96, not described, but figured on pl. 3, figs. 7–9. Paleocene, Northern Caucasus, USSR.

Gyroidina caucasica Subbotina, 1936, *ibidem*, not described, but figured on pl. 2, figs. 14–16. Paleocene, Northern Caucasus, USSR.

Haplophragmoides inaequilateralis Subbotina, 1936, *ibidem*, series B, fasc. 60, p. 9, pl. 1, fig. 5. Oligocene, Northern Caucasus, USSR.

——— *periferoexcavata* Subbotina, 1936, *ibidem*, p. 7, pl. 1, fig. 7 (non fig. 5). Oligocene, Northern Caucasus, USSR.

——— *sp.* Subbotina, 1936, *ibidem*, p. 9, pl. 1, fig. 6. Oligocene, Northern Caucasus, USSR.

Heterostomella gigantica Subbotina, 1936, *ibidem*, series A, fasc. 96, not described, but figured on pl. 1, figs. 15, 16. Upper Cretaceous, Northern Caucasus, USSR.

Nonion curvisepta Subbotina, 1936, *ibidem*, not described, but figured on pl. 6, figs. 22, 23. Upper Eocene, Northern Caucasus, USSR.

Nummulites atacicus (Leymerie) var. *striatiformis* Katscharawa, 1936, Inst. Geol. Georgie, Bull., vol. 2, no. 1, p. 34, pl. 1, figs. 18–22. Middle Eocene, Georgia, USSR.

——— *n. sp.* Katscharawa, 1936, *ibidem*, p. 31, pl. 1, figs. 23, 24. Middle Eocene, Georgia, USSR.

Trochammina sp. Subbotina, 1936, Trans. Geol. Oil-Prospect. Inst. Leningrad-Moscow, series B, fasc. 60, p. 10, pl. 1, fig. 8. Oligocene, Northern Caucasus, USSR.

Thurammina ovalis Subbotina, 1936, *ibidem*, p. 4, pl. 1, fig. 1. Oligocene, Northern Caucasus, USSR.

SUPPLEMENT TO INDEX OF NEW SPECIES FOR THE YEAR 1937

Nodosaria infra-oolithica Bartenstein and Brand, 1937, Senckenberg. Naturf. Ges., Abh., No. 439, p. 147. Not figured. Liassic, Germany.

SUPPLEMENTS TO INDEX OF NEW SPECIES FOR THE YEAR 1938

Ammodiscus infimus (Strickland) var. *elliptica* Putzer, **338,** p. 427, text fig. 4. Liassic, Germany.

Cristellaria frankei Putzer, **338,** p. 429, text fig. 6. Liassic, Germany.

Loftusia occidentalis Milovanovic, 1938, Vesn. Kr. geol. Inst. Jugoslavia, vol. 6, p. 132, pl. 3, figs. 1, 3, 4; pl. 4, figs. 1–3. Maestrichtian, Yugoslavia.

Paraschwagerina baschkirica Grozdilova, **328,** p. 122, pl. 3, fig. 5. Paleozoic, Ishimbajevo, USSR.

——— *sp. I* Grozdilova, **328** p. 121, pl. 3, fig. 3. Paleozoic, Ishimbajevo, USSR.

——— *tumidofusieides* Grozdilova, **328,** p. 117, pl. 3, fig. 2. Paleozoic, Ishimbajevo, USSR.

Rotalia skourensis Pfender, **337,** p. 64, text figs. 8, 9. Upper Cretaceous, Morocco.

Schwagerina anderssoni (Schellwien) var. *fusieides* Grozdilova, **328,** p. 105, pl. 2, fig. 5. Paleozoic, Ishimbajevo, USSR.

——— *belajensis* Grozdilova, **328,** p. 98, pl. 1, fig. 3. Paleozoic, Ishimbajevo, USSR.

——— *ellipsoides* Grozdilova, **328,** p. 111, pl. 3, figs. 1, 4, 6. Paleozoic, Ishimbajevo, USSR.

——— *sterlitamakensis* Grozdilova, **328,** p. 95, pl. 1, figs. 4, 7. Paleozoic, Ishimbajevo, USSR.

Silicotextulina deflandrei Frenguelli var. *mediterranea* Rampi, **339,** p. 46, text figs. 1–12. Recent, Mediterranean Sea.

SUPPLEMENTS TO INDEX OF NEW GENERA AND SPECIES FOR THE YEAR 1939

Anomalina piripaua Finlay, **96a,** p. 325, pl. 28, figs. 141–143. Upper Cretaceous, New Zealand.

Aragonia, gen. nov., Finlay, **96a,** p. 318. Family Heterohelicidae. Genotype: *Aragonia zelandica* Finlay 1939. Upper Cretaceous to Eocene.

——— *zelandica* Finlay, **96a,** p. 319, pl. 27, figs. 68, 69. Upper middle Eocene, New Zealand.

Asterigerina lornensis Finlay, **96a,** p. 324, pl. 29, figs. 146, 147. Basal Oligocene, New Zealand.

——— *waiareka* Finlay, **96a,** p. 324, pl. 29, figs. 144, 145. Lower Oligocene, New Zealand.

Bigenerina pliocenica Finlay, **96a,** p. 311, pl. 24, fig. 15. Lower Pliocene, New Zealand.

Bolivina affiliata Finlay, **96a,** p. 320, described, not figured. Upper Miocene, New Zealand.

——— *anastomosa* Finlay, **96a,** p. 320, pl. 27, figs. 75–77, 103, 111. Middle Miocene, New Zealand.

——— *pontis* Finlay, **96a,** p. 320, described, not figured. Basal Oligocene, New Zealand.

Bolivinita compressa Finlay, **96a,** p. 319, pl. 27 (not pl. D), figs. 101, 102. Upper Miocene, New Zealand.

——— *pliozea* Finlay, **96a,** —.319, described, not figured. Pliocene, New Zealand.

——— *pohana* Finlay, **96a,** p. 319, pl. 27, figs. 99, 100. Upper Miocene, New Zealand.

Buliminella browni Finlay, **96a,** p. 321, pl. 27, figs. 85, 86. Lower middle Eocene, New Zealand.

——— *sauria* Finlay, **96a,** p. 321, pl. 27, figs. 87, 97, 98. Upper Cretaceous, Santonian, New Zealand.

Dorothia agrestis Finlay, **96a,** p. 313, pl. 25, figs. 41, 42. Lower middle Eocene, New Zealand.

——— *biformis* Finlay, **96a,** p. 313, pl. 25, figs. 26–28. Upper Cretaceous, New Zealand.

Eggerella decepta Finlay, **96a,** p. 312, pl. 25, figs. 24, 25. Basal middle Eocene.

Ehrenbergina fyfei Finlay, **96a,** p. 323, pl. 28, figs. 119, 121, 122. Upper Miocene, New Zealand.

——— *marwicki* Finlay, **96a,** p. 322, pl. 28, figs. 112–118. Lower Miocene, New Zealand.

——— *osbornei* Finlay, **96a,** p. 322, pl. 28, figs. 120, 123, 124. Middle Miocene, New Zealand.

Elongobula, gen. nov. Finlay, **96a,** p. 321. Fam. Buliminidae. Genotype: *Elongobula chattonensis* Finlay, 1939. Upper Cretaceous to Upper Oligocene.

——— *chattonensis* Finlay, **96a,** p. 322, pl. 27, figs. 92–96. Upper Oligocene, New Zealand.

——— *creta* Finlay, **96a,** p. 322, pl. 27, figs. 88–91. Upper Cretaceous, Campanian, New Zealand.

——— *lawsi* Finlay, **96a,** p. 322, described, not figured. Upper Oligocene, New Zealand.

Frondicularia steinekei Finlay, **96a,** p. 316, pl. 26, fig. 62. Upper Cretaceous, Santonian, New Zealand.

——— *teuria* Finlay, **96a,** p. 316, pl. 26, figs. 60, 61. Upper Cretaceous, Campanian, New Zealand.

Gaudryina healyi Finlay, **96a,** p. 311, pl. 25, figs. 34, 35. Upper Cretaceous, Santonian, New Zealand.

——— *reliqua* Finlay, **96a,** p. 311, pl. 25, figs. 32, 33. Basal middle Eocene, New Zealand.

——— *whangaia* Finlay, **96a,** p. 311, pl. 25, figs. 29–31. Upper Cretaceous, Campanian, New Zealand.

Globorotalia collactea Finlay, **96a,** p. 327, pl. 29, figs. 164, 165. Middle Eocene, New Zealand.

——— *miozea* Finlay, **96a,** p. 326, pl. 29, figs. 159–161. Lower Miocene, New Zealand.

Gyroidina allani Finlay, **96a,** p. 323, pl. 28, figs. 134–136. Upper Oligocene, New Zealand.

——— *scrobiculata* Finlay, **96a,** p. 324, pl. 28, fig. 137. Upper Eocene, New Zealand.

——— *stineari* Finlay, **96a,** p. 324, described, not figured. Upper Miocene, New Zealand.

——— *zelandica* Finlay, **96a,** p. 323, pl. 28, figs. 138–140. Miocene, New Zealand.

Haeuslerella hectori Finlay, **96a,** p. 310, pl. 24, figs. 11, 12, 20. Lower Miocene, New Zealand.

——— *parri* Finlay, **96a,** p. 310, pl. 24, fig. 5. Lower Pliocene, New Zealand.

Marginulina allani Finlay, **96a,** p. 318, pl. 26, figs. 55, 56. Upper Oligocene, New Zealand.

Marginulinopsis marshalli Finlay, **96a,** p. 317,

pl. 26, figs. 47, 48. Lower middle Eocene, New Zealand.

——— *waiparaensis* Finlay, **96a,** p. 317, pl. 26, figs. 45, 46. Basal middle Eocene, New Zealand.

Matanzia mahoenuia Finlay, **96a,** p. 314, described, not figured. Lower Miocene, New Zealand.

——— *simulans* Finlay, **96a,** p. 314, pl. 25, figs. 21–23. Upper Cretaceous, Campanian, New Zealand.

Migros, gen. nov., Finlay, **96a,** p. 312. Fam. Verneuilinidae. Genotype: *Gaudryina medwayensis* Parr, 1935, Trans. Roy. Soc. New Zealand, vol. 65, pt. 2, p. 83, pl. 20, fig. 2. Middle Miocene to Recent.

Notorotalia powelli Finlay, **96a,** p. 323, described, not figured. Lower Miocene, New Zealand.

——— *serrata* Finlay, **96a,** p. 323, pl. 29, figs. 152, 153. Lower Miocene, New Zealand.

Palmula bensoni Finlay, **96a,** p. 315, described, not figured. Upper Eocene, New Zealand.

——— *bivium* Finlay, **96a,** p. 315, pl. 26, fig. 59. Upper middle Eocene, New Zealand. For: *Cristellaria cassis,* flabelline variety, Chapman, 1926 (non Fichtel and Moll, 1798), New Zealand Geol. Surv., Pal. Bull., vol. 11, p. 59, pl. 12, fig. 9.

——— *rakauroana* Finlay, **96a,** p. 314, pl. 26, figs. 51, 52. Upper Cretaceous, Santonian, New Zealand.

——— *taranakia* Finlay, **96a,** p. 315, described, not figured. Middle Oligocene, New Zealand.

——— *thalmanni* Finlay, **96a,** p. 315, pl. 26, figs. 53, 54. Upper Cretaceous, Campanian, New Zealand.

Planularia rakauroana Finlay, **96a,** p. 317, pl. 26, figs. 66, 67. Upper Cretaceous, New Zealand.

——— *whangaia* Finlay, **96a,** p. 317, pl. 26, figs. 63–65. Upper Cretaceous, Campanian, New Zealand.

Patellina piripaua Finlay, **96a,** p. 323, pl. 28, figs. 125–127. Upper Cretaceous, Santonian, New Zealand.

Planulina rakauroana Finlay, **96a,** p. 326, pl. 29, figs. 154–156. Upper Cretaceous, New Zealand.

Plectina agrestior Finlay, **96a,** p. 313, described, not figured. Upper middle Eocene, New Zealand.

——— *quennelli* Finlay, **96a,** p. 313, pl. 24, figs. 17–19. Upper middle Eocene, New Zealand.

Plectofrondicularia fyfei Finlay, **96a,** p. 319, pl. 27, fig. 110. Upper Miocene, New Zealand.

Pseudogaudryina anachrons Finlay, **96a,** p. 312, pl. 25, figs. 36, 37. Upper Oligocene, New Zealand.

Quadrimorphina, gen. nov., Finlay, **96a,** p. 325. Fam. Chilostomellidae. Genotype: *Valvulina allomorphinoides* Reuss, 1860, as figured and described by Cushman, 1931, Tennessee Geol. Bull., No. 41, p. 53, pl. 9, fig. 6. Upper Cretaceous to Eocene.

Rectobolivina maoria Finlay, **96a,** p. 320, pl. 27, figs. 82–84. Miocene, New Zealand.

——— *maoriella* Finlay, **96a,** p. 321, pl. 27, figs. 78–81. Middle Miocene, New Zealand.

Robulus dorothiae Finlay, **96a,** p. 314, pl. 27, figs. 107, 108. Lower Miocene, New Zealand.

Rotamorphina, gen. nov., Finlay, **96a,** p. 325. Fam. Chilostomellidae. Genotype: *Rotamorphina cushmani* Finlay, 1939. Upper Cretaceous.

——— *cushmani* Finlay, **96a,** p. 325, pl. 28, figs. 130–133. Upper Cretaceous, Campanian, New Zealand. For: *Valvulineria allomorphinoides* Cushman, 1932 (non Reuss, 1860), Proc. U. S. Nat. Mus., vol. 80, p. 46, pl. 14, fig. 2.

Sigmoidella bortonica Finlay, **96a,** p. 318, pl. 25, figs. 43, 44. Lower middle Eocene, New Zealand.

Siphotextularia acutangula Finlay, **96a,** p. 310, pl. 24, figs. 14, 16. Upper middle Eocene, New Zealand.

——— *wanganuia* Finlay, **96a,** p. 310, described, not figured. Uppermost Pliocene, New Zealand.

Spiroplectammina piripaua Finlay, **96a,** p. 309, pl. 24, figs. 3, 4, 6. Upper Cretaceous, New Zealand.

——— *steinekei* Finlay, **96a,** p. 309, pl. 24, figs. 1, 2. Upper Cretaceous, New Zealand.

Vagocibicides, gen. nov., Finlay, **96a,** p. 326. Fam. Cibicididae. Genotype: *Vagocibicides maoria* Finlay, 1939. Lower Miocene to Recent.

——— *maoria* Finlay, **96a,** p. 326, pl. 29, figs. 148–151, 158. Lower Miocene, New Zealand.

Virgulopsis, gen. nov., Finlay, **96a,** p. 321. Fam. Buliminidae. Genotype: *Virgulopsis pustulata* Finlay, 1939. Lower and Middle Miocene.

——— *pustulata* Finlay, **96a,** p. 321, pl. 27, figs. 72–74, 104–106. Middle Miocene, New Zealand.

Vulvulina büningi Finlay, **96a,** p. 310, pl. 24, figs. 9, 10. Upper Cretaceous, Campanian, New Zealand.

——— *jablonskii* Finlay, **96a,** p. 309, pl. 24, figs. 7, 8, 13. Middle Miocene, New Zealand.

Zeauvigerina parri Finlay, **96a,** p. 320, pl. 27, figs. 70, 71. Middle Eocene, New Zealand.

MANUSCRIPT RECEIVED BY THE EDITOR, APRIL 6, 1942.

JOURNAL OF PALEONTOLOGY, VOL 16, NO. 4, PP. 521–523, JULY 1942

REVIEWS

A SYMPOSIUM ON HYDROBIOLOGY, by James G. Needham, Paul B. Sears, Aldo Leopold, George S. Wehrwein, William H. Twenhofel, Stafford C. Happ, Clinton L. Utterback, Paul S. Welch, William L. Lea, Selman A. Waksman, Wayne W. Umbreit, Elizabeth McCoy, William W. Cort, William H. Weston, Neil Hotchkiss, George O. Burr, Carl L. Hubbs, John Van Oosten, David H. Thompson, Homer S. Swingle, E. V. Smith, Stanislas F. Snieszko, Arch E. Cole, Charles R. Cox, Willem Rudolfs, H. Heukelekian, Thomas R. Camp, Gerard A. Rohlich, William B. Sarles, Lewis H. Kessler, Bernard P. Domogalla, James P. Lackey, Charles E. Renn, Lowell T. Coggeshall, George O. Tapley, Marshall W. Jennison, Sterling Brackett, Donald B. McMullen, The University of Wisconsin Press, Madison, 1941, 405 pages.

The interrelations of the biological and physical sciences have much interest for many geologists. A branch of special interest is the relation of biological factors in aqueous bodies to the sediments deposited therein; the book here reviewed contains papers showing some of these relations.

The book consists of the papers presented in the regular program of a conference or symposium on hydrobiology, as applied to inland waters, sponsored by the University of Wisconsin and the Wisconsin Alumni Research Foundation. The symposium, the first of its type on the subject of limnological hydrobiology, was held at the University of Wisconsin in September 1940. One of the important purposes of the meeting was to provide opportunities and encourage discussion and exchange of ideas by those interested in different aspects of limnological hydrobiology.

The book contains 32 articles and 16 abstracts; eight of the former and four of the latter are of geologic interest. These papers of interest are:

Fragments of the history of hydrobiology by James G. Needham, Professor of Entomology and Limnology in Cornell University—9 pages.

This paper gives a vivid background and basis for investigation into many branches of hydrobiology. The major highpoints in the development of the science are more or less chronologically presented.

The sediments of inland lakes by William H. Twenhofel, Professor of Geology, University of Wisconsin—4 pages.

As one of the two papers geologic in scope, this short, detailed treatment of the sediments of lakes of the Upper Mississippi Valley is worthy of critical study. A more detailed discussion of the same subject by Twenhofel and McKelvey appears in the May 1941 issue of the Bulletin of the American Association of Petroleum Geologists.

The author presents information concerning the type of sediments found in lakes, the source of sediments, the character of the sediments, and the effect of general biological activity on the sediments.

Sedimentation in artificial lakes by Stafford C. Happ, Head of the Stream and Valley Section, Sedimentation Division, United States Soil Conservation Service—10 pages.

This is the second of two papers of definite geologic scope. The paper discusses the relation between soil erosion and sedimentation and the extent of the studies of sedimentation in artificial lakes undertaken by the Soil Conservation Serivce.

Dissolved oxygen in relation to lake types by Paul S. Welch, Professor of Zoology, University of Michigan—10 pages.

The role of dissolved oxygen in lakes and the classification of lakes are discussed in order to understand the relation of dissolved oxygen to lake types. Important conclusions are that dissolved oxygen seems to be definitely a major criterion of lake processes, but that it is not possible at present to establish general lake types on the basis of oxygen alone; there is no way at present to permanently relate dissolved oxygen to lake types until more is known about both dissolved oxygen and lakes. Lakes will probably be classified by a series of criteria; dissolved oxygen will probably appear as an important criterium.

Aquatic bacteria in relation to the cycle of organic matter by Selman A. Waksman,

Microbiologist, New Jersey Agricultural Experiment Station—21 pages.

The author presents information concerning the classification of bacteria, nature of organic matter in lakes, methods of study of transformation of organic matter, synthesis of organic matter, decomposition of plankton residues, abundance of organic matter in lake waters, chemical composition of the organic matter in lake bottoms, and transformation of organic matter in lake peats.

The information in this paper is fundamental and an inspiring basis for additional investigation into the subject.

Role of aquatic fungi in hydrobiology by William H. Weston, Professor of Botany, Harvard University.

This article is of special interest because it stresses the importance of the biological activities of the aquatic fungi in aquatic phenomena and gives clear, precise evidence supporting the thesis of importance of the group to processes of its environment.

The author predicts that as one of the two main groups of saprophytes in inland waters, the other group being heterotrophic bacteria, the aquatic fungi on further study will be found to play a part that compares favorabyl in amount, extent, and scope with that played by the aerobic bacteria.

A photographic method for the study of the organisms and conditions of the sea bottom by George L. Clarke, Associate Professor of Zoology, Harvard University and Biologist, Woods Hole Oceanographic Institution—2 pages.

This abstract describes briefly and discusses the results of the use of an underwater camera. Photographs from the camera permit a study of the nature of the bottoms of aquatic bodies in their undisturbed condition and the spatial distribution of the organisms living on the bottom. Clear photographs have been obtained with this camera at depths ranging from 40 to 200 meters.

Bacterial counts in the deep deposits of Trout Lake, Wisconsin by Philip L. Carpenter, Instructor in Bacteriology, Iowa State College—2 pages.

The vertical distribution of the percentage of different kinds of bacteria is presented and discussed in this abstract.

Fixation of silica by diatoms by Paul S. Conger, Research Associate, Carnegie Institution of Washington—1 page.

The synthesis of silica into organic structure by diatoms is discussed in regard to nature of the silica and conditions in natural waters governing the availability and use of silica.

Aspects of the hydrobiological importance of diatoms by Paul S. Conger, Research Associate, Carnegie Institution of Washington—1 page.

Diatoms are discussed from three hydrobiological standpoints, namely, as a prime and ultimate source of food, in sedimentation, and in sanitary engineering.

DAN E. FERAY
University of Wisconsin

CHESTER OSTRACODES OF ILLINOIS, by Chalmer L. Cooper; *Illinois Geological Survey, Report of Investigations* No. 77, pp. 1–101, plates 1–14, October 1, 1941.

This account fills an important gap in our knowledge of Mississippian faunas from the standard Mississippi Valley section. The scope of the work is well represented in the faunal chart, which lists 359 species under 67 genera. These are distributed among 13 families and 1 new subfamily, Amphissitinae. The richness of the Chester ostracode fauna is better appreciated when it is compared with the 310 species and 63 genera of brachiopods described from the entire Mississippian by Stuart Weller in 1914.

The first part of the report considers the distribution of Chester ostracodes and is accompanied by complete faunal and numerical lists for each of eight Chester formations. The greatest change in the Chester ostracode fauna occurs at the Hombergh-Elvira boundary. In the treatment of faunal relationships comparisons have been confined to units of the Chester, and Chester equivalents. However, attention is called to the fact that 22 genera are common to the Mississippian and Pennsylvanian, whereas, only 7 are common to the Mississippian and Devonian. Reference might also have been made to the close affinities of Chester species to Pennsylvanian species and the general lack of relationship to middle and lower Mississippian forms. Species of *Monoceratina*, *Healdia*, *Seminolites*, *Bairdia*, *Cavel-*

lina, Sulcella, Cornigella, Hollinella, Amphissites, Kirkbya, Discoidella, Jonesina, Knightina, Paraparchites, and *Moorites* are distinctly of the Pennsylvanian type; some of these genera make their first appearance in the Chester.

In his discussion of Chester correlations, Cooper considers the Amsden fauna described by Morey as closely related to the Clore. It should be pointed out that the ostracodes described by Morey came from the lower Amsden, which was named Sacajawea by C. C. Branson in 1938. The Sacajawea is definitely Mississippian, whereas, the revised name of Amsden designates certain Pennsylvanian strata.

In the classification of the family Kirkbyidae, Cooper recognizes a new subfamily Amphissitinae. *Amphissites* is divided into two new genera, *Ectodemites* and *Polytylites.* The development of posterior and anterior nodes in addition to the medial node readily distinguishes *Polytylites.* However, some difficulty may be experienced in separating many species of *Ectodemites* from *Amphissites.* Inner and outer costae are present on some species of both genera, and the rib along the dorsal shoulder, so characteristic of *Amphissites,* is also faintly developed in several species of *Ectodemites.* There is also a gradation between the medial node on *Amphissites* and the medial swelling on many *Ectodemites.*

Cooper goes a long way in clarifying the old and vexing *Jonesina-Sansabella* problem by stressing the differences in the hinge characters of the two genera. The importance of the hinge in the classification of Paleozoic ostracodes has been generally overlooked. Similarly, the importance of the direction of overlap has been greatly exaggerated. There can be little question concerning the existence of reversal of overlap in *S. truncata* Cooper and *S. bradfieldi* (Coryell and Sohn), both from the Golconda formation.

Cooper is to be especially complimented upon the quality of the 702 figures contained on 14 plates. The illustrations set the highest standard yet attained in the photography of ostracodes. Practically all species are illustrated by lateral, dorsal, and end views. Dorsal views showing the details of the hinge are indespensable in ostracode studies. More equally well illustrated papers and complete faunal studies will place the ostracodes in the foremost rank of index fossils.

HAROLD W. SCOTT
University of Illinois

JOURNAL OF PALEONTOLOGY, VOL. 16, NO. 4, PP. 524–529, JULY 1942

SOCIETY RECORDS AND ACTIVITIES

REPORTS AND MINUTES OF THE SIXTEENTH ANNUAL MEETING OF THE SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS

The sixteenth annual meeting of the Society of Economic Paleontologists and Mineralogists was held at Denver, Colorado. The meeting was held in conjunction with The American Association of Petroleum Geologists.

The Council of the Society met Wednesday afternoon, April 22, at which time the report of the secretary-treasurer was accepted. The Council authorized the possibility of introducing junior membership for the Society.

The annual business session of the Society was held Friday, April 24, 1942, at 9:00 A.M., with president Henry V. Howe in the chair.

Minutes of the 1941 meeting were approved as published in the *Journal of Paleontology*, Volume 15, Number 4 (July, 1941).

The following reports were given:

1. *Report of the Editor of the Journal of Paleontology* (Norman D. Newell, Editor).—Volume 15 of the *Journal of Paleontology* was published in collaboration with the Paleontological Society during 1941. A total of 707 pages and 85 full-tone plates were published comprising a bulk of paleontologic literature surpassing that of any other periodical in the field of paleontology. The Society was responsible for the March, July, and November issues, totaling 349 pages and 29 plates in addition to many text figures. In the issues sponsored by the Society 17 papers including 237 pages were devoted exclusively to micropaleontology. Through financial aid from the American Association of Petroleum Geologists, Society sponsored issues are appreciably larger than they were during 1940.

2. *Report of the Editor of the* Journal of Sedimentary Petrology (W. H. Twenhofel, Editor).—The *Journal of Sedimentary Petrology* appeared in the customary three numbers. More manuscripts should be submitted by members of the Society than is the case. The impact of the war seems to have had little effect upon the subscriptions.

3. *Report of the Research Committee* (W. H. Twenhofel, Chairman).—At the Austin, Texas, meeting of the Society, the committee explored the possibility of undertaking a listing of North American type specimens of fossils and their locations. Professor Carey Croneis was made chairman of a subcommittee with this work as its objective. Professor Croneis was given authority to select the members of his subcommittee. It was also decided at that meeting to investigate the possibility of listing the type sections of stratigraphic units together with statements giving present conditions. Professor Plummer was made chairman of a subcommittee with this objective. Both subcommittees made reports at the recent meeting in Denver and both were directed to continue their studies. M. A. Hanna and W. H. Twenhofel were directed at the Austin meeting to prepare papers pointing out fields where investigation is desirable, the former to prepare a paper dealing with stratigraphic and paleontologic problems; the latter, one dealing with mineralogy and petrology. The latter paper has been published and the former is ready for publication.

The committee arranged a symposium for the Denver, Colorado, meeting, which dealt with alteration of sediments after deposition. Four papers were read. The symposium was extremely well attended. It was directed that the four papers be published in the December 1942 number of the *Journal of Sedimentary Petrology*. It was decided to arrange a similar symposium for the next meeting of the Society.

4. *Report of the Secretary-Treasurer* (H. B. Stenzel, Secretary-Treasurer).—

BACK VOLUME SALES

Back volumes of the *Journal of Paleontology*	$681.30
Back volumes of the *Journal of Sedimentary Petrology*	$274.85

PRINTING AND ENGRAVING BILLS FOR 1941

Journal of Paleontology

	Banta Printing Bills	*Meriden Engraving Bills*	*Total Printing and Engraving Bills*	*S.E.P.M. Total Printing and Engraving Bills*
Number 1 (January)*	$ 627.16	$ 373.58	$1,000.74	
Number 2 (March)	636.67	189.82	826.49	$ 826.49
Number 3 (May)*	888.63	341.78	1,230.41	
Number 4 (July)	753.21	263.98	1,017.19	1,017.19
Number 5 (September)*	875.84	245.29	1,121.13	
Number 6 (November)	909.07	198.89	1,107.96	1,107.96
	$4,690.58	$1,613.34	$6,303.92	$2,951.64
(1940 Totals)	($4,136.03)	($1,322.56)	($5,458.59)	($2,568.91)

*Odd numbers paid for by Paleontological Society

Journal of Sedimentary Petrology

	Banta Printing Bills
Number 1 (April)	$ 281.10
Number 2 (August)	355.40
Number 3 (December)	325.34
	$ 961.84*
(1940 Total)	($1,008.71)

*Less $26.39—part payment by author

MEMBERSHIP, MAILING, AND JOURNAL STATISTICS

	March 1942	*March 1941*	*March 1940*	*March 1939*
1. S.E.P.M. Membership:				
Active Members	264	254	239	234
Associate Members	74	81	79	79
Total	338	335	318	313
2. *Journal of Paleontology* Mailing List:				
S.E.P.M. Active Members	219	220	214	201
S.E.P.M. Associate Members	48	52	50	52
S.E.P.M. Subscribers	244	272	280	340
P.S. Members	336	341	370	345
Total	847	885	914	938
3. *Journal of Sedimentary Petrology* Mailing List:				
S.E.P.M. Active Members	127	118	109	108
S.E.P.M. Associate Members	22	20	19	19
S.E.P.M. Subscribers	239	242	262	260
Total	388	380	390	387
4. Number of pages in 1941 *Journal of Paleontology*	707 (615, 1940)			
5. Number of plates in 1941 *Journal of Paleontology*	85 (69, 1940)			
6. Total edition of 1941 *Journal of Paleontology*	1300 (1300, 1940)			
7. Number of pages in 1941 *Journal of Sedimentary Petrology*	150 (149, 1940)			
8. Total edition of 1941 *Journal of Sedimentary Petrology*	500 (500, 1940)			
New members from March 1, 1941, to March 1, 1942	11 (16, 1940–1941)			
New Associates from March 1, 1941, to March 1, 1942	2 (16, 1940–1941)			
Transfers to active membership, March 1, 1941, to March 1, 1942	6 (7, 1940–1941)			

It was moved, seconded, and carried that all reports be accepted.

5. The results of the election of officers by mailed ballot, for the new year ending in April, 1943, were announced by Secretary Stenzel as follows:

President—Herschel L. Driver
Vice-President—Parker D. Trask
Secretary-Treasurer—H. B. Stenzel

6. The Society expressed its thanks to the College of Letters and Science of the University of Wisconsin for secretarial aid and expenses of correspondence and express charges in connection with the publication of the *Journal of Paleontology* and the *Journal of Sedimentary Petrology* and also for office space and equipment connected with such publication.

It was moved, seconded and carried that the above expression of thanks be sent to Dean George H. Sellery of the University of Wisconsin.

7. *Report of the Resolutions Committee* (M. L. Thompson, Chairman).—"Be it resolved that the Society of Economic Paleontologists and Mineralogists express its sincere appreciation and thanks to The American Association of Petroleum Geologists, the local committee, and the Rocky Mountain Association of Petroleum Geologists, for making the annual meeting at Denver such an outstanding success."

8. President Howe announced that both the outgoing and incoming officers had discussed and were making plans to take care of members who were entering National Service.

The business meeting adjourned at 9:30 A.M. and the following papers were presented:

W. H. TWENHOFEL, "The Rate of Deposition of Sediments: A Major Factor Connected with Alteration of Sediments after Deposition."

W. C. KRUMBEIN, "Physical and Chemical Changes in Sediments after Deposition."

E. C. DAPPLES, "The Effect of Macroorganisms upon Sediments."

CLAUDE E. ZOBELL, "Bacterial Activity and the Transformation of Marine Sedimentary Materials." (Read by E. Wayne Galliher)

M. L. THOMPSON, "The Stratigraphy and Fusulinid Faunas of the Marine Permian Wolfcamp in New Mexico."

F. B. PLUMMER, "Stratigraphy of the Marble Falls Formation in Central Texas." (By Title)

LOUIS R. WILSON, "Vicksburg Enoplostomellas." (By Title)

EDWARD MONSOUR, "Fossil Corals of the Genus *Turbinolia* from the Gulf Coast." (By Title)

BENJAMIN A. TATOR, "Smaller Miocene Mollusca." (By Title)

HUBERT G. SCHENCK, "Operations of Commercial Micropaleontologic Laboratories."

LOIS T. MARTIN, "Eocene Foraminifera from the Type Lodo Formation, Fresno County, California." (Read by H. G. Schenck)

R. HENDEE SMITH, "New Species of *Discocyclina* (*Aktenocyclina*) from Alabama and Texas." (Read by H. V. Howe)

R. STANLEY BECK, "Eocene Foraminifera from Cowlitz River, Lewis County, Washington." (Read by H. G. Schenck)

HANS E. THALMANN, "The Genus *Hantkenina* and Its Subgenera." (Read by H. G. Schenck)

R. WRIGHT BARKER, "Notes on Some Larger Foraminifera from the Lower Cretaceous of Texas." (By Title)

L. C. AYCOCK, "Caddell Eocene *Operculinoides*." (By permission of Phillips Petroleum Company—By Title)

WILLARD D. PYE, "Rapid Methods of Making Sedimentological Studies of Sands, Especially as Applied to Cores." (By Title)

E. B. BRANSON, "Teaching a Combination of Stratigraphy and Sedimentation in the University of Missouri." (By Title)

HANS E. THALMANN, "The Genus *Globotruncana* and Its Species." (By Title)

E. B. BRANSON and M. G. MEHL, "The Application of Conodont Studies to Rocky Mountain Stratigraphy." (By Title)

E. H. RAINWATER, "Notes on the Midway (Lower Eocene) in East-Central Mississippi." (By Title)

KENNETH P. MCLAUGHLIN, "Paleontology of the Fountain Formation of Colorado." (By Title)

FRANK E. LOZO, JR., "Micropaleontological Analysis of the Fredericksburg-Washita Contact in North-Central Texas." (By Title)

FINANCIAL STATEMENT, DIVISION OF PALEONTOLOGY AND MINERALOGY, FOR THE YEAR 1941

To the Council,
Society of Economic Paleontologists and Mineralogists.

In continuation of our examinations in prior years we have examined the accounting records of the Society of Economic Paleontologists and Mineralogists for the year ended December 31, 1941, and now present our report together with the following statements:

Exhibit	
A	Statement of Financial Condition, December 31, 1941
B	Statement of Income for the year ended December 31, 1941
Schedule	
1	Statement of Receipts and Disbursements for the year ended December 31, 1941

In connection with our examination, we reviewed the system of internal control and the accounting procedures of the Society and, without making a detailed audit of the transactions, have examined or tested accounting records of the Society and other supporting evidence, by methods and to the extent we deemed appropriate. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances and included all procedures which we considered necessary.

Inventory of publications represents approximately 26,900 Journals (exclusive of Journals in excess of complete sets for issues prior to 1941) including certain issues printed at the expense of the Paleontological Society for the years 1935 to 1941, inclusive, stated at appraised values of fifty cents each for Journals printed prior to 1941 or cost to either the Society of Economic Paleontologists and Mineralogists or the Paleontological Society for Journals printed in 1941. The Society of Economic Paleontologists and Mineralogists has agreed to distribute a portion of its income to the Paleontological Society; the amount accruing to the latter for the year 1941 amounted to $358.38.

In our opinion the accompanying statement of financial condition and related statement of income present fairly the position of the Society of Economic Paleontologists and Mineralogists at December 31, 1941, and the results of its operations for the year, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed) ARTHUR YOUNG & COMPANY, *Accountants and Auditors*
TULSA, OKLAHOMA
January 27, 1942

EXHIBIT A

STATEMENT OF FINANCIAL CONDITION
DECEMBER 31, 1941

ASSETS

CURRENT ASSETS:		
Demand deposits—		
The First National Bank and Trust Company, Tulsa, Oklahoma	$ 4,273.84	
National Bank of Commerce, Tulsa, Oklahoma	30.46	$ 4,304.30
Savings deposit—		
The First National Bank and Trust Company, Tulsa, Oklahoma		2,165.88
Accounts receivable—		
Printed matter less reserve of $84.00		14.02
TOTAL CURRENT ASSETS		$ 6,484.20
INVENTORY OF PUBLICATIONS—see report		14,081.62
FURNITURE AND FIXTURES	$ 482.60	
Less: Reserve for depreciation	192.46	290.14
DEFERRED CHARGES		512.04
TOTAL ASSETS		$21,368,00

LIABILITIES AND SURPLUS

CURRENT LIABILITIES:		
Accounts payable		$ 328.70
Accrued printers' charges		512.04
Amount due to Paleontological Society		358.38
TOTAL CURRENT LIABILITIES		$ 1,199.12
DEFERRED INCOME:		
Subscriptions to Journals	$ 1,228.20	
Membership dues for 1942 and 1943	572.00	1,800.20
SURPLUS:		
Balance, December 31, 1940	$17,296.79	
Net income for the year ended December 31, 1941 (Exhibit B)	1,071.89	
Balance, December 31, 1941		18,368.68
CONTINGENT LIABILITIES:		
All known liabilities of the Society at December 31, 1941 were recorded in the accounts and no litigation was pending at that date		
TOTAL LIABILITIES AND SURPLUS		$21,368.00

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

EXHIBIT B

STATEMENT OF INCOME FOR THE YEAR ENDED DECEMBER 31, 1941

OPERATING INCOME:		
Dues and subscriptions—		
Journals of Paleontology and *Sedimentary Petrology*		$ 840.00
Journal of Paleontology		2,887.90
Journal of Sedimentary Petrology		848.20
		$ 4,576.10
Sales of back numbers—		
Journal of Paleontology	$ 663.50	
Journal of Sedimentary Petrology	225.85	889.35
Sales of plates and reprints		202.73
Advertising		62.46
		$ 5,730.64
Less: Proportion of income accrued to Paleontological Society		358.38
		$ 5,372.26
COSTS AND EXPENSES:		
Cost of printing—		
Journal of Paleontology	$ 3,040.53	
Journal of Sedimentary Petrology	993.36	
	$ 4,033.89	
Clerical salaries	720.00	
Office rent	300.00	
Postage and mailing	279.61	
Audit fee	100.00	
Office supplies and expenses	134.62	
Bad debts	84.00	
Depreciation	48.26	
Other costs and expenses	97.25	
	$ 5,797.63	
Less: Increase in inventory of publications	357.78	5,439.85
		$ *67.59*
NON-OPERATING INCOME		
Donation from The American Association of Petroleum Geologists	$ 1,100.00	
Recovery of accounts previously charged off	28.00	
Interest on savings deposit	11.48	1,139.48
NET INCOME		$ 1,071.89

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

SCHEDULE 1

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED DECEMBER 31, 1941

DEMAND DEPOSITS, DECEMBER 31, 1940			$ 4,705.05
RECEIPTS:			
Membership dues and subscriptions—			
Year 1941—			
Journals of Paleontology and *Sedimentary Petrology*	$ 464.00		
Journal of Paleontology	1,743.68		
Journal of Sedimentary Petrology	514.00	$ 2,721.68	
Years 1942 and 1943—			
Journals of Paleontology and *Sedimentary Petrology*	$ 288.00		
Journal of Paleontology	1,130.40		
Journal of Sedimentary Petrology	344.40	1,762.80	
Sales of back numbers—			
Journal of Paleontology	$ 507.20		
Journal of Sedimentary Petrology	122.60	629.80	
Sales of plates and reprints		186.58	
Accounts receivable		267.34	
Donation from The American Association of Petroleum Geologists		1,100.00	
Miscellaneous		267.03	6,935.23
			$11,640.28
DISBURSEMENTS:			
Printing expenses—			
Journal of Paleontology	$2,298.95		
Journal of Sedimentary Petrology	1,093.70		
Engraving *Journal of Paleontology*	651.99	$ 4,044.64	
Postage and mailing		145.11	
Office rent		300.00	
Clerical salaries		720.00	
Audit fee		100.00	
Payment to Paleontological Society		313.64	
Editorial salaries		300.00	
Refund on subscriptions		41.66	
Office supplies and expenses		42.67	
Transfer to savings account		1,100.00	
Miscellaneous		228.26	7,335.98
DEMAND DEPOSITS, DECEMBER 31, 1941			$ 4,304.30

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

1941

STRATIGRAPHIC TYPE OIL FIELDS

A SYMPOSIUM OF
THIRTY-SEVEN ORIGINAL ARTICLES
BY FIFTY-TWO AUTHORS

Edited by A. I. LEVORSEN, *Tulsa, Oklahoma*
Chairman, A.A.P.G. Research Committee

Assisted by	N. WOOD BASS	*North Mid-Continent States*
	ROSS L. HEATON	*Rocky Mountain States*
	W. S. W. KEW	*California*
	D. PERRY OLCOTT	*South Mid-Continent States*
	THERON WASSON	*Eastern States*

Fields Described

CALIFORNIA—Edison and Kern Front fields
COLORADO—Greasewood field
KANSAS—Bush City, Chanute, Hugoton, Nikkel, Wherry, Zenith
KENTUCKY—Big Sinking field
LOUISIANA—University field
MICHIGAN—Shoestring gas fields
MONTANA-ALBERTA—Border-Red Coulee and Cut Bank
OHIO—Sand lenses
OKLAHOMA—Davenport, Dora, East Tuskegee, Olympic, Red Fork
PENNSYLVANIA—Music Mountain, Venango sands
TEXAS—Bryson, Cross Cut-Blake, Hardin, East Texas, Hitchcock, Hull-Silk, Lopez, Noodle Creek, O'Hern, Sand Belt, Seymour, Walnut Bend
WEST VIRGINIA—Gay-Spencer-Richardson, Shinnston
WYOMING—Osage field
ANNOTATED BIBLIOGRAPHY of 125 other fields

902 pp., 300 illus., 227 references in annotated bibliography

PRICE, $5.50, POSTPAID ($4.50 TO MEMBERS)

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
BOX 979, TULSA, OKLAHOMA, U.S.A.

"Much has been written on the origin of oil . . .
little on the nature of the substances from which it is derived."

SOURCE BEDS OF PETROLEUM

BY

PARKER D. TRASK AND H. WHITMAN PATNODE

REPORT OF INVESTIGATION SUPPORTED JOINTLY BY THE AMERICAN PETROLEUM INSTITUTE AND THE GEOLOGICAL SURVEY OF THE UNITED STATES DEPARTMENT OF THE INTERIOR FROM 1931 TO 1941

●

This report presents results of the American Petroleum Institute Research Project No. 4 on the origin and environment of source beds of petroleum. The work was carried on under the supervision of an Advisory Committee on which the following men have served: R. F. Baker, B. B. Cox, F. R. Clark, K. C. Heald, W. B. Heroy, L. P. Garrett, F. H. Lahee, A. W. McCoy, H. D. Miser, R. D. Reed, and L. C. Snider.

●

"Criteria for recognizing rocks that generate oil would help materially in prospecting for petroleum."

"The main object of this study of lithified deposits has been to determine diagnostic criteria for recognizing source beds."

- 566 pages, with bibliographies and index
- 72 figures, 152 tables
- Bound in blue cloth; gold stamped; paper jacket; 6x9 inches

PRICE: $4.50, POSTPAID

($3.50 TO A.A.P.G. MEMBERS AND ASSOCIATE MEMBERS)

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
BOX 979, TULSA, OKLAHOMA, U.S.A.

OFFICERS OF THE SOCIETIES

SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS

For the year ending April, 1943

President, HERSCHEL L. DRIVER, Los Angeles, Calif.

First Past-President, H. V. HOWE, University, La.

Second Past-President, CAREY CRONEIS, Chicago, Ill.

Vice-President, PARKER D. TRASK, Washington, D.C.

Secretary-Treasurer, H. B. STENZEL, Austin, Texas.

Society Headquarters, 705 Wright Bldg., Tulsa, Okla.

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS

For the year ending April, 1943

President, FRITZ L. AURIN, Fort Worth, Tex.

Past-President, EDGAR W. OWEN, San Antonio, Tex.

Vice-President, PAUL WEAVER, Houston, Tex.

Secretary-Treasurer, EDMOND O. MARKHAM, Tulsa, Okla.

Editor, W. A. VER WIEBE, Wichita, Kan.

Association Headquarters, 708 Wright Bldg., Tulsa, Okla.

PALEONTOLOGICAL SOCIETY

For the year ending December, 1942

President, E. H. SELLARDS, Austin, Tex.
Vice-President, A. K. MILLER, Iowa City, Iowa.
Secretary, H. E. VOKES, New York, N.Y.
Treasurer, R. R. SHROCK, Cambridge, Mass.
Editor, C. WYTHE COOKE, Washington, D.C.

Ex-Presidents

R. W. CHANEY, Berkeley, Calif., 1939
C. O. DUNBAR, New Haven, Conn., 1940
L. W. STEPHENSON, Washington, D.C., 1941

Chairman, Cordilleran Section

SIEMON W. MULLER, Stanford University, Calif.

GEOLOGICAL SOCIETY OF AMERICA

For the year ending December, 1942

President, DOUGLAS JOHNSON, New York, N.Y.
Past-President, C. P. BERKEY, New York, N.Y.

Vice-Presidents

E. L. BRUCE, Kingston, Ontario.
CHESTER R. LONGWELL, New Haven, Conn.
L. W. STEPHENSON, Washington, D.C.
F. E. WRIGHT, Washington, D.C.

Secretary, H. R. ALDRICH, New York, N.Y.
Treasurer, E. B. MATHEWS, Baltimore, Md.

Councillors

CHARLES H. BEHRE, JR. KIRK BRYAN CARL O. DUNBAR	1940–1942
CHARLES E. WEAVER E. L. DE GOLYER WILLIAM W. RUBEY	1941–1943
WILLIAM O. HOTCHKISS A. I. LEVORSEN ROLLIN T. CHAMBERLIN	1942–1944